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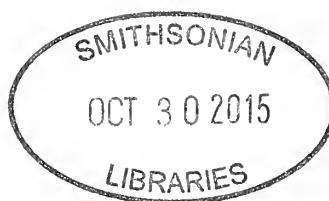
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A new species of the genus *Ectemnius* Dahlbom, 1845 from Cameroon (Hymenoptera: Crabronidae)

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Abstract: A new species of the genus *Ectemnius* Dahlbom, 1845, belonging to the subgenus *Policrabro* Leclercq, 1958 is described and illustrated: *Ectemnius babanki* sp. n. from the North West province of Cameroon. It is compared with a morphologically similar species *Ectemnius seyrigi* (Arnold, 1945) from Madagascar. A check-list of all members of the genus *Ectemnius* from the Afrotropical Region is also provided.

Keywords: Taxonomy, *Policrabro*, distribution data, Afrotropical Region.

INTRODUCTION

The genus *Ectemnius* Dahlbom, 1845 is worldwide in distribution, but only six species and one subspecies are known from the Afrotropical Region (including Madagascar) (Pulawski, 2014). Pulawski (2014) listed 188 species classified by Leclercq (1999) into eighteen subgenera.

The new species described herewith is a member of the subgenus *Policrabro* Leclercq, 1958. The subgenus includes 23 species from the Australasian Region and only one species from the Afrotropical Region: *Ectemnius seyrigi* (Arnold, 1945) from Madagascar (Leclercq, 1999). The diagnostic characters of the subgenus are given by Leclercq (1999) and, to judge from his work, the sparse mesopleural punctuation, twelve antennal segments and the presence of the pygidium in the males appear to be most characteristic.

MATERIAL AND METHODS

Most morphological terms are used as in Bohart & Menke (1976) with a few additions from Lomholdt & Pulawski (2010). The antennae are considered to consist of: scape, pedicel and flagellum (flagellomeres I to X). The terms for the surface sculpturing are taken from the glossary by Harris (1976).

Labels of the type specimens were cited as originally given, and the different lines are separated by a forward slash (/). The type specimens are provided with red, printed labels bearing the following text: "HOLOTYPE

[or PARATYPE] / *Ectemnius (Policrabro) / babanki* sp. nov. ♂ / M. Říha et J. Farkač det. 2014". The holotype has moreover a cardboard with genitalia, tergum VII, and sterna VII and VIII glued on.

Abbreviations in the text include: MHNG - Muséum d'Histoire Naturelle, Genève, Switzerland and MRBC - Martin Říha, Brno, Czech Republic (personal collection).

TAXONOMIC PART

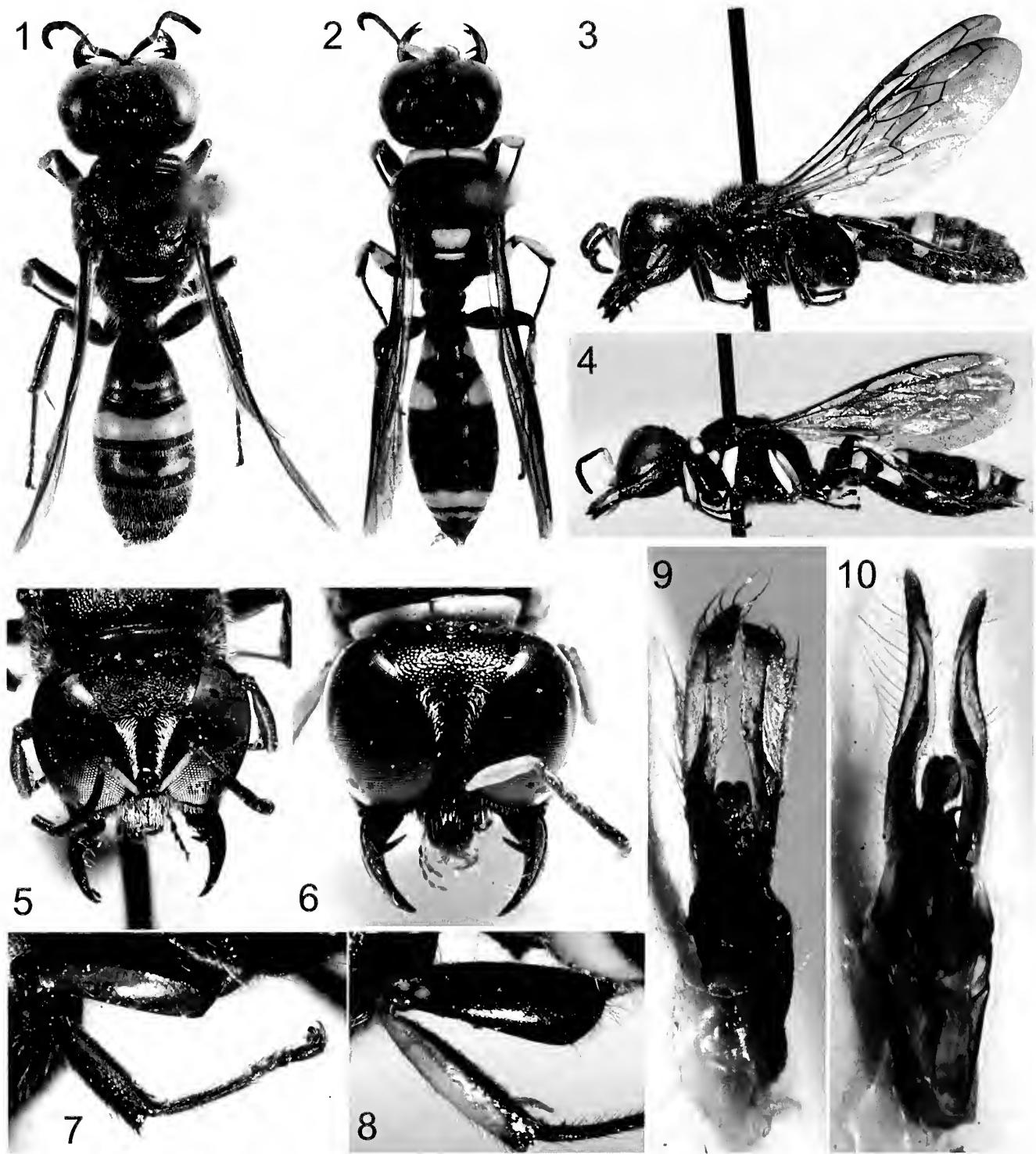
Ectemnius (Policrabro) babanki sp. n.

Figs 1, 3, 5, 7, 9

Holotype: MRBC, without registration number; labelled "CAMEROON; North-West prov.; / E env. of Big Babanki; 1200 m; / 06°06.698'N 10°15.938'E; / 5.-13.iii.2008; Martin Říha leg.", male.

Paratype: MHNG, without registration number; same data as holotype; one male.

Description: Holotype. Length 7.7 mm (Paratype 8.0 mm). Body black. Antennal scape beneath, metanotum, small median spot on tergum I, wide band on tergum II (not reaching anterior and posterior margins) and two small spots on tergum III pale yellow. Pedicel and flagellomeres I-III, mandible largely (except bifid apex and inner tooth), labium, palpi, pronotal collar, pronotal lobe, tegula, and precostal plate, two lateral spots on scutellum, apices of all coxae, all trochanters, forefemur (except basal black spot), mid- and hind-femora beneath, fore- and hind-tibiae beneath,



- Fig. 1. *Ectemnius babanki* sp. n. (holotype), dorsal view.
 Fig. 2. *E. seyrigi* (Arnold, 1945) (Andasibe), dorsal view.
 Fig. 3. *E. babanki* sp. n. (holotype), lateral view.
 Fig. 4. *E. seyrigi* (Arnold, 1945) (Andasibe), lateral view.
 Fig. 5. *E. babanki* sp. n. (holotype), head, frontal view.
 Fig. 6. *E. seyrigi* (Arnold, 1945) (Andasibe), head, frontal view.
 Fig. 7. *E. babanki* sp. n. (holotype), foreleg, lateral view.
 Fig. 8. *E. seyrigi* (Arnold, 1945) (Andasibe), foreleg, lateral view.
 Fig. 9. *E. babanki* sp. n. (holotype), aedeagus, ventral view.
 Fig. 10. *E. seyrigi* (Arnold, 1945) (Andasibe), aedeagus, ventral view.

sides of terga I-VI, hindmargin of tergum VI, and entire tergum VII ferruginous. Pterostigma and veins of all wings dark brown.

Head as seen from above transverse (Fig. 1), length : width ratio 5 : 9 (dorsal view). Pubescence white, 1.7-2.2 × as long as diameter of midocellus, erect. Mandible bifid apically, with conspicuous inner tooth at basal third (Fig. 5). Median lobe of clypeus elongate, apical free margin rectangular, 1.5 × as wide as diameter of midocellus, smooth, laterally with small rounded tooth. Scapal basin slightly depressed, covered with dense silver pubescence laterally, width of glossy medial part equal to two diameters of midocellus (Fig. 5). Frons rather dull, irregularly sculptured, individual punctures not defined anteriorly and forming grooves backwards, interspaces with indications of carinae. Vertex glossy, interspaces between punctures less than their diameter. Gena glossy, with only minute setiferous punctures. Occipital carina not reaching hypostomal carina by distance equal to two diameters of midocellus. Ocellocular distance: postocellar distance = 10 : 9. Scape with one keel. Flagellomeres I-III slightly bulged beneath, dull, with narrow and inconspicuous tyloidea. Flagellomere IV notched beneath. Relative lengths of antennal scape: pedicel: flagellomeres I to X (last) = 37 : 8 : 12 : 9 : 9 : 10 : 5 : 5 : 5 : 6 : 8.

Pronotum medially notched, without conspicuous carina, lateral corners rounded. Scutum and scutellum rather shiny, punctured. Scutal punctures elongate, forming fine longitudinal ridges anteriorly, ridges slightly larger posteriorly and directed diagonally on postero-lateral corner. Scutellar punctures elongate lengthwise. Metanotum shiny, finely punctate. Propodeal enclosure inconspicuously but distinctly delimited by fine carina, basally longitudinally ridged, medially striate, median sulcus slightly indicated. Propodeal side and metapleuron shiny and finely longitudinally striated. Posterior part of propodeum strongly transversally keeled with conspicuous median sulcus. Epicnemial carina slightly curved backward ventrally, vanishing between striation of posterior part of propleuron. Mesopleuron and mesosternum glossy, interspaces between punctures about twice as large as their diameter. Mesopleuron with conspicuous precoxal keel ventrally curved forward. Mesosternum with short transverse carinae medially. Pubescence of thorax 1.7-2.2× as long as diameter of midocellus, erect. Forefemur keeled basally, with one keel baso-ventrally and one postero-basally. Forebasitarsus inconspicuously curved, longer than following tarsomeres together (Fig. 7).

Abdomen sessile. Pubescence 1-1.5× as long as diameter of midocellus, semierect. Terga slightly shiny, microsculptured, tergum I also with scattered punctures. Sternum I with conspicuous keel on basal half, bifurcate backwards. Pygidial plate present, subquadratic, microsculptured, slightly depressed apically, more so basally. Parameres of aedeagus rather wide all over its length (Fig. 9).

Comparison: *E. babanki* sp. n. differs from the related species *E. seyrigi* in the features indicated in the key below. The key is based on the males only, because the female of *E. babanki* sp. n. is unknown. The female is very likely to have the same distinguishing characters – mainly the colour and body sculpture. The key to the Asian species was given by Leclercq (1999).

Etymology: The new species is named after Big Babanki, a village in the North West province of Cameroon, where the type material was collected. It is a noun in apposition.

Distribution: So far only known from the type locality in North West Cameroon.

Habitat: Collected individually on leaves of high-grown *Mangifera* sp., on the occasionally burned off grassy slope, on the edge of the village, at an altitude of about 1200 m.

Ectemnius (Policrabro) seyrigi (Arnold, 1945)

Figs 2, 4, 6, 8, 10

Material examined: MRBC, without registration number; E MADAGASCAR, Tamatave distr., Andasibe; 17.-30.xii.2001; David Hauck leg; one male.

Key to the Afrotropical species of *Ectemnius* subgenus *Policrabro*

1. Maculation of thorax and legs generally dark red (Figs 1, 3), tergum I with small yellow spot, tergum II with wide yellow band, terga V and VI immaculate (Fig. 1), forefemur carinate basoventrally (Fig. 7), forebasitarsus inconspicuously curved (Fig. 7), flagellomeres I-III slightly bulged beneath, dull, with narrow and inconspicuously indicated tyloidea, propodeal enclosure medially striate, aedeagus with parameres wide (Fig. 9) *Ectemnius babanki* sp. n.
- Maculation of thorax and legs generally pale yellow (Figs 2, 4), terga I and II with lateral yellow spots, terga V and VI largely yellow (Fig. 2), forefemur obliquely rounded basoventrally (Fig. 8), forebasitarsus markedly curved, flagellomeres I-III conspicuously bulged beneath, with conspicuous, wide and glossy tyloidea, propodeal enclosure medially smooth with sparse punctures, aedeagus with parameres narrow (Fig. 10) *Ectemnius seyrigi* (Arnold, 1945)

List of Afrotropical species of *Ectemnius* Dahlbom

Subgenus *Metacrabro* Ashmead, 1899

- Ectemnius abyssinicus* (Arnold, 1947): Ethiopia
Ectemnius cripesi ssp. *cripsei* (Arnold, 1927): Zimbabwe
Ectemnius cripesi ssp. *mozambicus* (Arnold, 1960): Mozambique

Subgenus *Hypocrabro* Ashmead, 1899

- Ectemnius praeclarus* (Arnold, 1945): Madagascar
Ectemnius slateri (Arnold, 1926): Madagascar, Mozambique, South Africa, Zimbabwe

Subgenus *Policrabro* Leclercq, 1958

- Ectemnius seyrigi* (Arnold, 1945): Madagascar
Ectemnius babanki sp. n.: Cameroon

Subgenus ambiguous (see below)

- Ectemnius arrogans* (Arnold, 1958): Zimbabwe
 Note: The subgeneric, and perhaps even the generic, status of *Ectemnius arrogans* (Arnold, 1958) is questionable. Pulawski (2014) attributed this species to the genus *Ectemnius*. Arnold (1958) in the original description, however, lists characters (mainly the absence of the precoxal carina) that exclude the placement of *E. arrogans* in this genus, and based on the same description, this species presumably does not belong to the subgenus *Policrabro*. The correct generic classification of this species can be established only through an examination of the type material.

ACKNOWLEDGEMENTS

We would like to thank to the Faculty of Forestry and Wood Sciences (Czech University of Life Sciences in Prague) for support to Cameroonian expedition in 2008, all our friends from Big Babanki, who willingly helped us, and L. Dembický (Moravian Museum, Brno) for the help with taking photos of the specimens.

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An annotated list of the orthopteroid insects described by Kurt Harz, with an account of the type specimens held in the Muséum d'histoire naturelle de Genève

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Abstract: Kurt Harz described 98 species or subspecies of orthopteroid insects. The names are listed, their current combination and the location of the types are given. Where the primary type specimens are in Harz's collection, now in the Muséum d'histoire naturelle de Genève (MHNG), the sex, verbatim label data and condition of the specimens is given, along with their location within the collection.

Keywords: Blattodea - Dermaptera - Mantodea - Orthoptera - type-catalogue.

INTRODUCTION

Kurt Harz (1915-1996) was a German entomologist who, despite being wheelchair-bound and self-taught, became one of the most important authorities on the European Orthoptera. His early work was on the Lepidoptera, and he was head of the German Research Centre for Migratory Lepidoptera for twenty years. His interest in the orthopteroid insects led to the monumental three volume "Die Orthopteren Europas" (Harz, 1969b, 1975c; Harz & Kaltenbach 1976). In 1975 he started the periodical "Articulata" (which became the journal of the Deutsche Gesellschaft für Orthopterologie in 1988) to which he contributed many articles.

The very proliferation of Harz's publications has caused some problems for the compilers of taxonomic catalogues. Detzel (1996) lists the publications of Harz, while Heller (1998, 1999) lists the taxa described by Harz, and clears up a few nomenclatural problems. Heller omits the mantid *Kinzlebachia ragnari* Harz, 1988d [a junior synonym of *Rivetina caucasica caucasica* (Saussure, 1871)]. He also ignored two publications (Harz, 1991, 1992), presumably because of doubts about their validity under the code (see Ingrisch & Willemse, 2004). These are included here because some of the names have been cited in the subsequent literature (e.g. Ünal, 2011).

Harz was somewhat lax in his descriptions, which were often cursory, and sometimes omitted to designate holotypes. He sometimes labelled specimens as paratypes when they were not mentioned in the original description, or had even been collected after its publication. Harz was particularly careless in designating neotypes since he generally designated a pair of specimens (not always

from the same locality) which were sometimes not from anywhere near the type locality. Although some of his neotype designations have been accepted, others have not (Marshall, 1983) and a discussion of Harz's neotypes is deferred pending further research.

The Muséum d'histoire naturelle de Genève, Switzerland (MHNG), acquired Harz's personal collection in 1975 and 1976, and also received most of the specimens that he studied after this date, although not always straight away. The Harz collection of Orthoptera is maintained as a separate collection in the MHNG because its size makes integration into the general collection impractical. His Blattodea, Dermaptera and Mantodea, however, have been integrated into the general collection. Since Heller (1998, 1999) does not indicate the whereabouts of the type specimens, an inventory of Harz's species including comments on the condition of the type specimens in the MHNG is desirable.

ARRANGEMENT AND FORMAT

The species are listed alphabetically. The format for each is:

specific epithet Author, publication: page [*Original generic placement*].

Provenance as given in the original description. Type series.

Specimen: "Label data" [format of label]. Following the recommendations of Ohl & Oswald (2004) the condition of each primary type specimen is noted. Other comments. Location of material in the MHNG main Orthoptera collection.

Currently valid combination. Nomenclature follows Beccaloni (2014) for the Blattodea, de Jong (2014) for the Dermaptera, Eades *et al.* (2014) for the Orthoptera and Otte *et al.* (2014) for the Mantodea.

The following abbreviations are used in the list:
 BMNH The Natural History Museum, London
 MHNG Muséum d'histoire naturelle de Genève
 MNMS Museo Nacional de Ciencias Naturales, Madrid
 NHMW Naturhistorisches Museum Wien
 OSF Orthoptera Species Files (Eades *et al.*, 2014)
 RMNH Naturalis Biodiversity Center, Leiden
 SMFD Forschungsinstitut und Naturmuseum Senckenberg, Frankfurt
 SMNK Staatliches Museum für Naturkunde, Karlsruhe
 SMNS Staatliches Museum für Naturkunde, Stuttgart
 SMTD Staatliches Museum für Tierkunde, Dresden
 ZFMK Zoologisches Forschungsinstitut und Museum "Alexander Koenig", Bonn
 ZMAS Zoological Museum, Russian Academy of Sciences, St. Petersburg
 ZMHB Museum für Naturkunde, Berlin
 ZSMC Zoologische Staatsammlung München

CATALOGUE

Blattodea

agenjoi Harz, 1971c: 343-344 [*Phyllodromica*].

Spanien, Bacares. ♂ Holotype.

No specimens found in the MHNG. According to the original description the holotype was deposited in the MNMS.

Phyllodromica agenjoi Harz, 1971

beybienkoi Harz, 1985b: 189 [*Tartaroblatta*].

Dschausli. ♀ Holotype and 1 ootheca.

No specimens found in the MHNG. According to the original description the type material was deposited in the ZMAS.

Tartaroblatta beybienkoi Harz, 1985

chladeki Harz in Chládek & Harz, 1977: 24 [*Phyllodromica*].

Slowakei, Muránska planina. ♂ Holotype, 11 ♂ paratypes and 28 ♀ paratypes.

There are two ♂ paratypes and two ♀ paratypes (one of each card mounted and the other in alcohol) in the MHNG collection. According to the original description the holotype and other paratypes were deposited in collection of F. Chládek. Box Blattodea 16 and alcohol collection.

Phyllodromica chladeki Harz, 1977

ebneri Harz, 1975b: 7 [*Phyllodromica*].

Palästina, Khudeia bei Haifa. ♂ Holotype, 1 ♂ paratype and 2 ♀ paratypes.

The ♂ paratype which was stated to be deposited in Harz's collection is currently on loan from the MHNG (being described as the holotype on the loan form). According to the original description the ♂ holotype was deposited in the NHMW, but only a ♀ paratype is held there (also currently on loan). The whereabouts of the other specimens is unknown. Box Blattodea 16.
 A junior synonym of *Luridiblatta beybienkoi* (Maran, 1957)

eckerleini Harz, 1977b: 28-29 [*Ectobius*].

Frankreich, Montagne de Lure. ♀ Holotype and 1 ♀ paratype.

Holotype ♀ with labels: "France, Montagne de Lure, 9.viii.1956, Dr. H. Eckerlein leg." [handwritten by Harz on white card]; "Ectobius eckerleini n. sp. K. HARZ det." [handwritten by Harz on white card]; "Holotypus" [handwritten by Harz on red card]. The specimen is card mounted having been directly pinned previously. The claws of the left front leg, the tarsi of the right front, middle and hind legs, and the claws of the left hind leg are missing. The ♀ paratype is also present. Box Blattodea 11.

Ectobius eckerleini Harz, 1977

fernandesii Harz, 1975b: 6-7 [*Ectobius*].

Spanien, Bosque de Cernadas. ♂ Holotype, 1 ♂ paratype and 2 ♀ paratypes.

There is one ♂ paratype in the MHNG collection. The ♂ holotype is in the NHMW, as stated in the original description. There are also three ♀, one labelled as allotype and two as paratypes. It is not clear whether one of these was added after the publication of the description (and is thus not part of the type series) or the number of specimens given in the original description was incorrect. Box Blattodea 12.

A junior synonym of *Ectobius lucidus* (Hagenbach, 1822)

hispanica Harz, 1975a: 4 [*Loboptera*].

Spanien, Totana. ♂ Holotype and 4 ♀ paratypes.

Holotype ♂ with labels: "Espana, Totana, 24.-25.05.1969, Eitschberger et Mager leg." [printed on white card]; "Loboptera hispanica n. sp. det. Kurt HARZ" [handwritten by Harz on white card]; "HOLOTYPE" [printed on red card]. The specimen is card mounted. The end of the abdomen has been dissected and is mounted on four glass microscope slides which are stored in a plastic container in the insect box. Two ♀ paratypes, one labelled as allotype, are also present. According to the original description one ♀ paratype was deposited in what is now part of the MNMS; the whereabouts of the other paratype is unknown. Box Blattodea 25.

Loboptera hispanica Harz, 1975

gaschei Harz, 1985b: 187-189 [*Tartaroblatta*].

Tatschikistan, Höhe am Anisor-Pass. ♀ Holotype, 1 ♀ paratype and 3 immature paratypes.

Holotype ♀ with labels: "USSR, Tatschikistan, Dushanbe, 3376 m, Ansor Pass, 19.7.1984, D. GASCHE" [handwritten by Harz on white card]; "Tartaroblatta gaschei HARZ Kurt HARZ det" [handwritten by Harz on white card with "Kurt HARZ det" printed]; "MHNG coll. Harz" [printed on white card]; "Holotypus" [handwritten by Harz on red card]. The specimen is card mounted. The left antenna, the tarsi of the left front leg, right middle leg, the last tarsal segment of the left middle leg, the tarsi of the right hind leg and the entire left hind leg are missing. The four paratypes are also present in the MHNG collection. Box Blattodea 24.

Tartaroblatta gaschei Harz, 1985

llorentae Harz, 1971c: 343 [*Phyllodromica*].

Spanien, Menorca. ♂ Holotype and 6 ♀ paratypes. Although the original description states that a ♀ paratype was deposited in the MHNG, no specimens were found in the collection. According to the original description the holotype and remaining paratypes were deposited in the MNMS.

Phyllodromica llorentae Harz, 1971

lodosi Harz, 1983b: 45-46 [*Ectobius*].

Türkei, Zonguldak-Bartin. ♂ Holotype, 11 ♂ paratypes and 3 ♀ paratypes.

Three ♂ and one ♀, all specimens apparently labelled as paratypes, are currently on loan from the MHNG. According to the original description two ♂ paratypes and one ♀ paratype were deposited in Harz's collection and the holotype and other paratypes were deposited in the collection of N. Lodos.

Ectobius lodosi Harz, 1983

maculata marani Chládek & Harz, 1980: 176-178 [*Phyllodromica*].

Slovakischer Karst, Domica. ♂ Holotype, 53 ♂ paratypes and 39 ♀ paratypes.

There are two card mounted ♂ paratypes and two card mounted ♀ paratypes in the MHNG collection. According to the original description the holotype and other paratypes were deposited in the collection of F. Chládek. Box Blattodea 16.

Pyllodromica marani Chládek & Harz, 1980

nadigi Harz, 1976b: 19-20 [*Phyllodromica*].

Elba, Mad. de Monte. ♂ Holotype, 9 ♂ paratypes and 8 ♀ paratypes.

Holotype ♂ with labels: "Elba 23.8.1959, Mad. d. Monte, 450-600m leg. Nadig" [handwritten by Nadig on white card with "Elba", "1959" and "leg. Nadig" printed]; "Phyllodromica nadigi n. sp. Kurt HARZ det." [handwritten by Harz on white card with "Kurt HARZ det." printed]; "Holotypus" [handwritten by Harz on red card]. The specimen is micro-pinned to a card mount secured on a larger pin which also carries the labels. The tarsi of the right hind leg are missing. There are also eight

♂ paratypes and six ♀ paratypes, one labelled as allotype, in the MHNG. The whereabouts of the other paratypes is unknown. Box Blattodea 15.

Phyllodromica nadigi Harz, 1976

Dermoptera

thaleri Harz, 1980: 156-157 [*Chelidurella*].

Innsbruck, Gross-Glockner. ♂ Holotype and 17 paratypes (6 in alcohol).

Card-mounted ♂ holotype with labels: "K. THALER, Nord-Tirol, Umg. Innsbruck, Maria Waldfast 16.11.76 – 4.5.1977, Fallen" [handwritten by Harz on white card]; "Chelidurella thaleri sp. n. Kurt HARZ det. 1980" [handwritten by Harz on white card with "Kurt HARZ det. 1980" printed]; "ex coll. K. Harz" [printed on a strip of white card]; "Holotypus" [handwritten by Harz on red card]. The right antenna is broken off at the fifth segment. There are eleven card mounted specimens and five specimens in alcohol, all collected by Thaler in 1977, labelled as paratypes in the MHNG collection. The whereabouts of the other paratype is unknown. Box Dermoptera 14 and alcohol collection.

Chelidura thaleri (Harz, 1980)

Mantodea

kinzelbachi Harz, 1988d: 208 [*Kinzelbachia*].

Anatolien, Ruins of Castalar (Heiropolis). ♂ Holotype and 8 immature paratypes.

Juvenile ♂ holotype with labels: "Türkei, Ruins of Castalar (Heiropolis), 37.11-36.11, 23.7.1986, 86/71 R. KINZELBACH" [handwritten by Harz on white card]; "Kinzelbachia kinzelbachi n. sp. ♂ Kurt HARZ det" [handwritten by Harz on white card with "Kurt HARZ det" printed]; "Holotypus" [handwritten by Harz on red card]. Both antennae are missing and the middle and hind legs are detached. Numerous fragments of leg and the terminalia are glued on to three eard mounts (each with "Kurt HARZ det" printed) secured on the original pin. The eight paratypes are also present in the MHNG. As noted by Roy & Cuche (2008), the neotype designated by Ehrmann (2000: 3) is not valid. Box Mantodea 37a. A junior synonym of *Rivetina asiatica* Mistshenko, 1967

ragnieri Harz, 1988d: 208-209 [*Kinzelbachia*].

Türkei, Ruins of Castalar (Heiropolis). ♂ Holotype and 2 immature paratypes.

Juvenile ♂ holotype with labels: "TR Ruins of Castalar (Hieropolis), 37° 11' / 36° 11', 23.07.86 / 77 leg. Kinzelbach" [handwritten on white paper]; "F6" [handwritten in pencil on a square of white paper]; "Klebe: Eukit, Losber. xy/0/7/6" [handwritten by Harz on white card]; "Kinzelbachia ragnieri sp. n. Kurt HARZ det" [handwritten by Harz on white card with "Kurt HARZ det" printed]; "Holotypus" [handwritten by Harz

on red card]. The holotype is broken; the meso and metathorax with the right middle leg and the abdomen remain on the pin, the head, prothorax and front legs are glued to an identification label with "Klebe: Eukit, Lösungsmittel F6♀" handwritten by Harz on the other side, and the right hind leg is glued to a piece of white card, both secured on the original pin. The left middle and hind legs are missing, as are the antennae, the tarsi of the right middle leg and the claw of the right hind leg. The abdomen is shrivelled. The two paratypes are also present in the MHNG. As noted by Roy & Cuche (2008), the neotype designated by Ehrmann (2000: 3) is not valid. Box Mantodea 37c.

A junior synonym of *Rivetina caucasica caucasica* (Saussure, 1871)

Orthoptera

apricarius tatrae Harz, 1971a: 335 [*Chorthippus*].

CSSR, Höhlenrain (Hohe Tatra). ♂ Holotype, 2 ♂ paratypes and 7 ♀ paratypes.

The original description states that a pair of paratypes was deposited in Harz's collection, but these could not be found in the MHNG. The holotype and six paratypes, one labelled as allotype, are in the NHMW, as stated in the original description.

Pseudochorthippus montanus tatrae (Harz, 1971)

beieri Harz, 1966b: 21 [*Antaxius*].

Val Verzasca, Sonogno, Tessin. ♂ Holotype.

No specimens found in the MHNG. The holotype is in the SMNS according to Holstein & Ingrisch (2004) (images on OSF).

Antaxius beieri Harz, 1966.

biguttulus yersini Harz, 1975d: 895 [*Chorthippus*].

Leon, collado de Carmen. ♂ Holotype, 13 ♂ paratypes and 6 ♀ paratypes.

Holotype ♂ with labels: "U. Eitschberger et H. Steiniger leg. Espana (Léon) Cdo de Carmen, 1300-1400m" and "20 Aug. 1972" [printed on different sides of the same piece of white card]; "Holotypus" [printed on red card with "Holo" added by hand]; "Chorth. biguttulus yersini n. ssp. K. HARZ d." [printed on white card]. Specimen set with right wings spread and left wings folded. The left front leg is missing. A micro-tube containing dissected parts is secured through the stopper on the original pin. There are seven ♂ and two ♀ specimens labelled as allotype and paratypes in the MHNG collection. According to the original description, further paratypes were deposited in the NHMW (where one specimen can be identified) and in the collection of C. Walther; the latter are now in the SMFD (images on OSF). Box Harz 145.

Chorthippus yersini Harz, 1975

bolivari muchei Harz, 1979c: 127 [*Tetrix*].

Tadzhikistan, Gori Bachmal. ♂ Holotype, 3 ♂ paratypes and 6 ♀ paratypes.

Holotype ♂ with labels: "Tadzhikistan, Gori Bachmal, 90km E Samarkand, 1600m, 22.5.1979 W. H. MUCHE" [handwritten by Harz on white card]; "HOLOTYPE" [printed on red card]; "Tetrix bolivari muehei sub sp. n. det. Kurt HARZ 1979" [handwritten by Harz on white card with "det. Kurt HARZ 1979" printed]. Specimen set with wings folded. One antenna and the right hind leg are missing; the other antenna is glued to a card mount secured on the original pin. There are three ♂ and six ♀ specimens with the same data and labeled as allotype and paratypes. Box Harz 45a.

A junior synonym of *Tetrix bolivari* Saulcy, 1901

bornhalmi Harz, 1971a: 336-338 [*Chorthippus*].

Jugoslawien, Dubrovnik. ♂ Holotype, 3 ♂ paratypes and 3 ♀ paratypes.

According to the original description two ♂ paratypes and one ♀ paratype were deposited in Harz's collection but there is only one ♂ paratype and one ♀ paratype in the MHNG. The original description states that the rest of the type specimens were deposited in D. Bornhalm's collection, which was left to the ZFMK. Box Harz 132. *Chorthippus bornhalmi* Harz, 1971

brevipennis vicheti Harz, 1975d: 625 [*Arcyptera*].

Herault, Collines de la Gardiole. ♂ Holotype, 2 ♂ paratypes and 4 ♀ paratypes.

Holotype ♂ with labels: "HERAULT, Collines de la Gardiole, 7.58, G. de Vichet" [handwritten on white card with "HERAULT" and "G. de Vichet" printed]; "Holotypus" [printed on white card disk with printed red margin]; "Arcyptera brevipennis vicheti HARZ, det. K. HARZ" [handwritten by Harz on white card]. Specimen set with right wings spread and left wings folded. The left front leg and the last tarsal segment of the right hind leg are missing. Dissected genitalia are glued to a card mount secured on the original pin. There are two ♀ and four ♀ specimens labelled as allotype and paratypes in the MHNG collection. Boxes U25 and Harz 99.

Arcyptera brevipennis vicheti Harz, 1975

carinthiaca kisi Harz, 1973c: 404 [*Miramella*].

Rumänien, Valea Mare, Moldavia. ♂ Holotype and 1 ♀ paratype.

Holotype ♂ with labels: "Moldova N Valea Mare 14.viii.1967 leg. B. Kis" [handwritten on white card with black printed margin]; "Miramella irena Fruhst.?" [handwritten on white card with black printed margin]; "Kisiella carinthiaca carpathica [sic] n. ssp. det. K. HARZ" [handwritten by Harz on white card]; "Holotypus" [handwritten by Harz on red card]; "M. irena (FRUHST.) ♂ det. NADIG" [printed on white paper]. Specimen set with wings folded. Both antennae and the last tarsal segment of both front legs are missing. There is a micro-

tube with dissected parts secured through the stopper on the original pin. A ♀ specimen with the same data and labelled as allotype is also present. Box Harz 56b.

A junior synonym of *Miramella irena* (Fruhstorfer, 1921)

carinthiaca puschnigi Harz, 1973c: 404 [*Miramella*].
Kärnten, Heidner Höhe, Eisenhut. ♂ Holotype, 1 ♂ paratype and 2 ♀ paratypes.

There is one ♂ paratype and one ♀ paratype in the MHNG. The holotype is in the NHMW, as stated in the original description, along with one ♂ and one ♀ specimens, both labelled as paratypes. It is not clear whether one of these was added after the publication of the description (and thus is not part of the type series) or the number of specimens given in the original description was incorrect, but Baur & Coray (2004) accept all of the specimens as paratypes. Box Harz 56b.

A junior synonym of *Miramella carinthiaca* (Obenberger, 1926)

chopardi Harz, 1971a: 332 [*Chorthippus*].

New name for *Omocestus corsicus montanus* Chopard, 1924, which Harz placed in the genus *Chorthippus* and therefore became a junior homonym of *Chorthippus montanus* (Charpentier, 1825).

A junior synonym of *Chorthippus corsicus* (Chopard, 1924)

concolor peneri Harz, 1970a: 192 [*Conocephalus*].

Hazeva. ♂ Holotype, 6 ♂ paratypes and 6 ♀ paratypes. The MHNG collection contains three ♂ and two ♀ paratypes. There are another five paratypes in the BMNH (the presence of type material is indicated by their online database). According to the original description the holotype and two ♀ paratypes were deposited in the collection of the Hebrew University in Jerusalem. Images on OSF. Box Harz 10.

Conocephalus concolor peneri Harz, 1970

cristatus sulcatus Harz, 1973a: 245 [*Pamphagus*].

Monts de Belezma-Seriana, Algerien. ♂ Holotype. Holotype ♂ with labels: "Algerien, Monts de Belezma-Seriana, 18 Mai 1971, Dr. ECKERLEIN" [handwritten by Harz on white card]; "Holotypus, P. cristatus sulcatus n. ssp. det. K HARZ" [handwritten by Harz on white card with "Holotypus" underlined with red ink]; "Holotypus" [printed on red card]. The tarsi of the left front leg are missing. A micro-tube with dissected parts is secured through the stopper on the original pin. Box Harz 47.

A junior synonym of *Pamphagus cristatus* Descamps & Mounassif, 1972

derrai Harz, 1983a: 13-14 [*Rhacolceis*].

Ostkreta, Maronia. ♂ Holotype.

Holotype ♂ with labels: "16.10.1982, Kreta, 3km südl. Maronia, 200m leg. Gg. Derra" [handwritten on white card with "Kreta" and "leg. Gg. Derra" printed];

"Rhacocleis derrai spec. n. Kurt HARZ det" [handwritten by Harz on white card with "Kurt HARZ det" printed]; "Holotypus" [handwritten by Harz on red card]. The last tarsal segment of the left front leg is missing. Dissected genitalia are glued to a card mount secured on the original pin. Images on OSF. Box Harz 27.

Rhacoleis derrai Harz, 1983

derrai Harz, 1988a: 117-121 [*Stenobothrus*].

Türkei, Silvas bei Gürün. ♂ Holotype and 1 ♀ paratype. Holotype ♂ with labels: "Türkei, Sivas 22.7.1984/7, 5km W Gürün, 1700m leg. Derra/Hacker" [printed on white card with "/7" handwritten]; "Stenobothrus derrai n. sp. Holotypus Kurt HARZ det" [handwritten by Harz on white card with "Kurt HARZ det" printed]; "Holotyp." [handwritten by Harz on red card]. The left and right wings are glued to two card mounts secured on the original pin. The right middle and both hind legs are lost, the tibia and tarsi of the right front leg are glued to the upper card mount along with the left wings. A micro-tube with dissected genitalia is secured through the stopper on the original pin. A much damaged specimen with the same data and labelled "allotypus" is also present. Box Harz 109.

Stenobothrus derrai Harz, 1988

descampsi Harz, 1971b: 339 [*Tridactylus*].

Angola. ♂ Holotype, 2 ♂ paratypes and 1 ♀ paratype. There is one ♂ paratype in the MHNG. According to the original description the other type specimens were deposited in the MNHN. Box Harz 46.

Xya descampsi (Harz, 1971)

dispar giganteus Harz, 1975d: 644 [*Chrysocraon*].

Baldarin Sumpf, Albanien. ♂ Holotype, 6 ♂ paratypes and 2 ♀ paratypes.

No specimens found in the MHNG. There are eight specimens collected by Ebner in 1918 from localities in Albania mentioned in the original description present in the NHMW collection; these are presumably part of the type series although they are not labelled as such.

Chrysocraon dispar giganteus Harz, 1975

donskoffi Harz, 1971b: 340 [*Tridactylus*].

Angola. ♀ Holotype.

No specimens found in the MHNG. According to the original description the holotype was deposited in the MNHN.

Xya donskoffi (Harz, 1971)

ebneri Harz, 1966a: 26 [*Conocephalus*].

Albanien, Baldrin-Sumpf. ♂ Holotype and 3 ♀ paratypes. No specimens found in the MHNG. The ♂ holotype and three ♀ paratypes are in the NHMW, as stated in the original description.

Conocephalus ebneri Harz, 1966

eckerleini Harz, 1975d: 877-880 [*Chorthippus*].
Obereichstätt, Mittelfrancken. ♂ Holotype, 13 ♂ paratypes and 5 ♀ paratypes.
Holotype ♂ with labels: “12.7.1958, bei Obereichstätt leg. Walther” [handwritten on white card with “leg. Walther” printed]; “*Chorthippus eckerleini* spec. n. K. HARZ det.” [printed on white card]; “HOLOTYPE” [printed on pink card]. Specimen set with right wings spread and left wings roughly folded. Most of the right antenna, the last tarsal segment of the right middle leg and the entire left middle leg are missing. A micro-tube with dissected parts is secured through the stopper on the original pin. There are five ♂ paratypes and four ♀ paratypes, one labelled as allotype, present in the MHNG; the whereabouts of the other paratypes is unknown. Box Harz 122.
A junior synonym of *Chorthippus vagans vagans* (Eversmann, 1848).

ehrmanni Harz, 1991: 3 [*Platycleis*].

Türkei, Bochram. ♀ Holotype.

Holotype ♀ with labels: “Türkei, 11v1990, Bochram am Golf v. Kerme. M. Stieve leg.” [handwritten by Harz on white card]; “*Platycleis ehrmanni* sp. n. Kurt HARZ det” [handwritten by Harz on white card with “Kurt HARZ det” printed]; “Holotypus” [handwritten by Harz on red card]. Most of both antennae, the right front leg, both middle legs and the left hind leg are lost. It is not clear whether this name is available because the description was printed in a newsletter that may not be a valid publication under the ICBN (Ingrisch & Willemse, 2004). The name is treated as nomen nudum by Massa & Fontana (2011) and on OSF. Box Harz 16.

Platycleis ehrmanni Harz, 1991

eitschbergeri Harz, 1976a: 55-56 [*Discotilla*].

Spanien, Teruel, Sierra Alta. ♂ Holotype.

Holotype ♂ with labels: “HISPANIA, Teruel, Sierra Alta, 30.VII.72, EITSCHBERGER leg.” [printed on white card]; “*Discotilla eitschbergeri* n. sp. det. K. HARZ” [handwritten by Harz on white card]; “HOLOPARATYPUS” [printed on red card and modified by hand]; “*Petaloptila* sp. (larva) det. Gorochov” [handwritten on white card]. Most of the left antenna, the tarsi of the right middle leg and two tarsal segments of the right hind leg are lost. There is a micro-tube with dissected parts secured through the stopper on the original pin. Box Harz 41.

A junior synonym of *Petaloptila aliena* (Brunner von Wattenwyl, 1882)

eitschbergeri Harz, 1973b: 344 [*Podisma*].

Piemont, Valdieri, Capella San Giovanni. ♂ Holotype and 2 ♀ paratypes.

Holotype ♂ with labels: “Piemont, Valdieri, Capella San Giovanni, 1400m, 28.viii.1970 EITSCHBERGER” [handwritten by Harz on white card]; “*Podisma eitschbergeri* n. sp. K. HARZ det.” [handwritten by Harz

on white card]; “*Podisma pedestris* (L.) det. K. HARZ” [printed on white card]; “HoloParatypus” [handwritten by Harz on red card]. Both antennae are missing. There is a micro-tube with dissected parts secured through the stopper on the original pin. Two ♀ specimens with the same data are labelled allotype and paratype. Box Harz 55.

Podisma eitschbergeri Harz, 1973

ephippiger mischtschenkoi Harz, 1966d: 129 [*Ephippiger*].

Kiev, Kanew. ♂ Holotype and an unspecified series of paratypes.

No specimens found in the MHNG. The holotype is deposited in the NHMW as stated in the original description, accompanied by two ♂ paratypes and three ♀ paratypes.

Ephippiger ephippiger mischtschenkoi Harz, 1966

ephipper moralesagacinoi Harz, 1966d: 127 [*Ephippiger*].

España, Lérida, Virgen de Arés. ♂ Holotype and 1 ♀ paratype.

Holotype ♂ with labels: “Prov. De Lerida, 1923 M. ESCALERA” [printed on white card]; “Virgende Arés, PTO. PAYÁS” [printed on white card]; “Morales-Agacino don. 1965” [handwritten by Harz on white card]; “*Ephippiger vitium* Serv. *moralesagacinoi*, ♂, Kurt Harz det.” [handwritten by Harz on white card with “Kurt Harz det.” printed, and “Holotypus” handwritten by Harz in red ink on the reverse]; “Holotypus” [printed on red card]. The tarsi of the left hind leg are lost. Dissected genitalia are glued to a card mount secured on the original pin. The ♀ paratype is also in the MHNG despite the fact that the original description states that it would be deposited in the ZSMC. Box Harz 30.

A junior synonym of *Ephippiger diurnus diurnus* Dufour, 1841

ephippiger vicheti Harz, 1966d: 130-131 [*Ephippiger*].

Trentino, Storo. ♂ Holotype, 12 ♂ paratypes and 11 ♀ paratypes.

There are no specimens from the type series in the MHNG. The holotype is in the NHMW as stated in original description, along with one ♂ and four ♀ paratypes. According to the original description there are further paratypes in the collections of the BMNH, ZMHB and ZSMC. Box Harz 30.

A junior synonym of *Ephippiger persicarius* Fruhstorfer, 1921

faberi Harz, 1975c: 17-18 [*Platysolus*].

Spanien, C.º de Carmen. ♂ Holotype, 5 ♂ paratypes and 7 ♀ paratypes.

Holotype ♂ with labels: “U. Eitschberger et H. Steiniger leg. España (Léon) C.º de Cármenes 1300-1400m” and “20.AUG.1972” [printed on opposite faces of

white card]; "HOLOTYPE" [printed on red card]; "Platystolus faberi n. sp. det. K. HARZ" [handwritten by Harz on white card]. The left hind leg is glued to a card mount secured on the original pin. There are ten other specimens with the same data and labelled as allotype and paratypes. Images on OSF. Box Harz 35.

Callicrania faberi (Harz, 1975).

ganevi Harz, 1986: 266-267 [Pholidoptera].

Rhodopen, Persenk Mine. ♀ Holotype.

Holotype ♀ with labels: "BULGARIA, Rhodopen, Persenk-mine 1000-1200m, 15.7.1985, J. GANEV" [printed on white card with "15.7" and "5, J. GANEV" handwritten]; "Holotypus" [handwritten by Harz on red card]; "Pholidoptera ganevi n. sp. Kurt HARZ det." [handwritten by HARZ on white card with "Kurt HARZ det." printed]. The claws of the right front leg, the tarsi of the right middle leg and the tarsi of the left hind leg are missing. The tibia and first tarsal segment of the right hind leg are glued to a card mount secured on the original pin. Images on OSF. Box Harz 24.

A junior synonym of *Pholidoptera aptera bulgarica* Maran, 1953

greini Harz, 1977a: 27-28 [Poecilomon].

Jugoslawien, Triglav, Bergstation Bohinjsko-See Seilbahn. ♂ Holotype and 1 ♀ paratype.

Holotype ♂ with labels: "Jugoslavia, Bolinj Gebiet des Triglav, S des Bolinjsko-Jezero Sees, G. GREIN leg. viii.1977, 1525m" [handwritten by Harz on white card]; "Poecilimon greini n. sp. K. HARZ det." [handwritten by Harz on white card]; "Holotypus" [handwritten by Harz on red card]. Three tarsal segments of the left front leg and the claws of the right middle and hind legs are lost. The left middle and right hind legs appear to have been reattached with glue. There is another specimen with the same data labelled as the allotype present. Images on OSF. Box Harz 7.

A junior synonym of *Poecilimon ornatus* (Schmidt, 1850)

guentheri Harz, 1976a: 55 [Gryllomorpha].

Griechenland, Rentina-Tal. ♂ Holotype and 2 ♀ paratypes.

Holotype ♂ with labels: "Hellas, Rentinatal, 19.viii.1971 auf Kulturgebäude, R. KINZELBACH" [handwritten by Harz on white card]; "Gryllomorpha guentheri n. sp. K. HARZ det." [handwritten by Harz on white card]; "HOLOPARATYPUS" [printed on red card and modified by hand]. The specimen is card mounted. Most of both antennae, the left middle leg, two tarsal segments of the right middle leg and the entire right hind leg are missing. The left front and hind leg are detached and glued to the card mount; both lack the last two tarsal segments. There is a micro-tube with dissected parts secured through the stopper on the original pin. There are also two immature ♀ specimens with the same data and labelled as paratypes in the MHNG. Box Harz 40.

Gryllomorpha miramae guentheri Harz, 1976

hackeri Harz, 1988c: 137-138 [Phaneroptera].

Türkei, 12 km von Hakkari. ♂ Holotype and 1 ♀ paratype. Holotype ♂ with labels: "Türkei, 12.9.1985/14, 12 km w Hakkari, 1500m leg. Hacker" [printed on white card with /14 handwritten]; "Phaneroptera hackeri n. sp. Kurt HARZ det." [handwritten by Harz on white card with "Kurt HARZ det." printed]; "Holotypus" [handwritten by Harz on red card]. Specimen fragmented and glued to three card mounts on the same pin. The top card mount has most of the thorax and the abdomen with the left wings and hind leg, which lacks the tarsi. The middle card mount has the right middle and hind legs, the former lacking the tarsi. The lower card mount has the head and most of the prothorax and the right hind wing. The antennae, right front wing, both front legs and the left middle leg are lost. There is a ♀ specimen with the same data labelled as allotype. Images on OSF. Box Harz 1.

Phaneroptera hackeri Harz, 1988

hannae Harz, 1991: 2 [Platycleis].

Bulgarien, Ograzden, Sastrino. ♀ Holotype and 1 ♀ paratype.

Holotype ♀ with labels: "Bulgaria, Ograzden, Sastrino, 31.5.1991, Ganev" [handwritten by Harz on white card]; "Platycleis hannae n. sp. Kurt HARZ det" [handwritten by Harz with "Kurt HARZ det" printed]; "Holotypus" [handwritten by Harz on red card]. Most of both antennae, the tarsi of the right front leg and the last tarsal segment of the right hind leg are lost. There is a second ♀ labelled as an unspecified type in the MHNG collection. It is not clear whether this name is available because the description was printed in a newsletter that may not be a valid publication under the IZN code (Ingrisch & Willemse, 2004). The name is treated as a nomen nudum by Massa & Fontana (2011) and on OSF. Box Harz 16.

Platycleis hannae Harz, 1991

†*harzensis* Harz, 1967b: [Nephoptera].

Willershausen. ♀ Holotype.

No specimens found in the MHNG. According to the original description the holotype (specimen 584-13) was deposited in the Geologisch-Paläontologische Institut of Göttingen University.

†*Nephoptera harzensis* Harz, 1967

huxleyi Harz, 1971b: 342 [Tridactylus].

Senegal, St. Luis. ♂ Holotype, 2 ♂ paratypes and 3 ♀ paratypes.

There is a pair of paratypes in the MHNG. According to the original description the other type specimens were deposited in the BMNH, and type material is indicated on their online database. Box Harz 46.

Xya huxleyi (Harz, 1971)

indistinctus Harz, 1979b: 115 [Tridactylus].

A new name for *T. musicus* Harz, 1978c, a junior homonym of *T. musicus* Tindale, 1928.

A junior synonym of *Tridactylus pfaendleri* Harz, 1970

jacobssi Harz, 1975d: 890-891 [*Chorthippus*].

Calanda. Holotype ♂ and 35 ♂ and 44 ♀ paratypes.

Holotype ♂ with labels: "Hispania, Calanda, 13.9.1972 Harz et al. legit" [printed on white card with the date altered by hand]; "Holotypus" [printed on red card]; "Chorthippus jacobssi spec. n. K. HARZ det." [printed on white card]. Specimen set with right wings spread and left wings folded. There are 73 specimens labelled as allotype and paratypes in the MHNG collection. According to the original description two paratypes were deposited in the MNSN, and there are further paratypes in the SMFD (images on OSF). Box Harz 133.

Chorthippus jacobssi Harz, 1975

johnseni Harz, 1982a: 227-229 [*Chorthippus*].

Marokko, Ain-el-Leuh, Azrou. ♂ Holotype, 1 ♂ paratype and 2 ♀ paratypes.

Holotype ♂ with labels: "Marokko, Ain-el-Leuh b. Azrou, 4.u.5.8.59, Eckerlein leg." [printed on white card]; "Chorthippus johnseni n. sp. Kurt HARZ det" [handwritten by Harz on white card with "Kurt HARZ det" printed]; "Holotypus" [handwritten by Harz on red card]. Specimen set with wings folded, most of the right front wing is glued to a card mount secured on the original pin. The right front leg and both hind legs are missing. The tibia and tarsi of the right middle leg are glued to the abdomen, which is much repaired, but the femur is missing. The specimen appears to have been broken where the pin is inserted in the thorax and repaired with glue. Dissected genitalia are glued to a card mount secured on the original pin. A specimen with the same data and labelled as the allotype is also present. Box Harz 132b.

Chorthippus johnseni Harz, 1982

kaestneri Harz, 1972: 129-130 [*Stenobothrus*].

Spanien, La Granja. ♂ Holotype and 2 ♀ paratypes.

There is a ♀ paratype in the MHNG collection. The ♂ holotype is in the NHMW, as stated in the original description, along with one ♀ paratype which is labelled as allotype. Box Harz 108b.

Omocestus viridulus kaestneri (Harz, 1972)

kaltenbachi Harz, 1965: 443 [*Barbitistes*].

Insel Lesina. 12 ♂ syntypes and 16 ♀ syntypes.

No specimens found in the MHNG. The species was described from a series of specimens from Brunner von Wattenwyl's collection, now in the NHMW. Harz did not designate a holotype and so all of these specimens must be considered syntypes. The NHMW contains 31 specimens identifiable as possible syntypes, of which one has been labelled as the holotype, one as allotype, and 16 as paratypes.

Barbitistes kaltenbachi Harz, 1965

kaltenbachi Harz, 1987d: 588-590 [*Sphodromerus*].

Syrien, Palmyra, Tal der Gräber, leg. Kaltenbach. ♂

Holotype and 4 ♀ paratypes.

Holotype ♂ with labels: "Syrien, Palmyra, Tal der Gräber, 14.11.1981, R. KINZELBACH [sic]" [handwritten by Harz on white card]; "Holotypus" [handwritten by Harz on red card]; "Sphodromerus kaltenbachi n. sp. Kurt HARZ det." [handwritten by Harz on white card with "Kurt HARZ det." printed]. Specimen set with right wings spread and left wings folded. Most of the left antenna, the tarsi of the right front leg, the last tarsal segment of both middle legs, the last tarsal segment of the left hind leg and the tarsi of the right hind leg are missing. Dissected parts of the genitalia are glued to a card mount secured on the original pin. There are also three ♀ paratypes in the MHNG, one labelled as the allotype. Harz stated in the original publication that another ♀ paratype was deposited in the collection of Kaltenbach, and this specimen is now in the NHMW. Box Harz 64.

Sphodromerus kaltenbachi Harz, 1987

kinzelbachi Harz, 1975b: 8-9 [*Ancistrura*].

Griechenland, Chalkidike, Choloman. ♂ Holotype.

Holotype with labels: "Graecia, Cholomon (Chalkidike) 19.viii.1971 KINZELBACH" [handwritten by Harz on white card]; "Ancistrura kinzelbachi n. sp. det. K. HARZ" [handwritten by Harz on white card]; "HOLOTYPE" [printed on pink card]. Most of the right antenna, two tarsal segments of the left front leg, the claws of the right middle leg, the last tarsal segment of the right hind leg and the entire left hind leg are missing. Images on OSF. Box Harz 4.

A junior synonym of *Ancistrura nigrovittata* (Brunner von Wattenwyl, 1878)

kinzelbachi Harz, 1971a: 331 [*Discotila*].

Griechenland, Karpathos, Grillenhöhle. ♂ Holotype and 2 ♂ paratypes.

Holotype ♂ with labels: "Graecia, Karpathos, 31.iii.1963 Grillenhöhle R. KINZELBACH" [handwritten by Harz on white card]; "Karpathos, 31.3.1963, Grillenhöhle" [handwritten in pencil on white card]; "Discotila kinzelbachi K. HARZ det. K. HARZ" [handwritten by Harz on white card]; "Holotypus" [printed on white card disc with printed red border]. The specimen is card mounted and has lost the left middle leg, two tarsal segments of the right middle leg, the tarsi of the left hind leg and the entire right hind leg. A micro-tube with dissected parts is secured through the stopper on the original pin. A ♂ and an immature ♂ with the same data are labelled as paratypes. Box Harz 41.

Ovaliptila kinzelbachi (Harz, 1971)

kinzelbachi Harz, 1981: 179-181 [*Eupholidoptera*].

Griechenland, Lakonia, Githion. ♂ Holotype.

Holotype ♂ with labels: "Hellas, Lakonia, Githion, 17.7-5.8.1980, No. 300 R. KINZELBACH" [handwritten by Harz on white card]; "Eupholidoptera kinzelbachi n. sp. Kurt HARZ det" [handwritten by Harz on white

card with "Kurt HARZ det" printed]; "Holotypus" [handwritten by Harz on white card with hand coloured red border]; "Holotypus" [printed on red card]. The last tarsal segment of the left hind leg and the claws of the right hind leg are missing. Dissected genitalia are glued to a card mount secured on the original pin. Images on OSF. Box Harz 25.

A junior synonym of *Eupholidopterus megastyla* (Ramme, 1939)

kinzelbachi Harz, 1979a: 107 [*Glandulosa*].

Türkei, Cebelib, Tobrauk Su. ♂ Holotype.

Holotype ♂ with labels: "Türkei, Cebelib S. Antakya, Tobrauk Su (Dafni Quelle) 10.III.1977 R. KINZELBACH et al. Rg. Nr. 15" [handwritten by Harz on white card]; "Glandulosa kinzelbachi sp. n. det. Kurt HARZ 1979" [handwritten by Harz on white card with "det. Kurt HARZ 197" printed]; "Fam. Gryllidae, Gattung Glandulosa HARZ" [handwritten by Harz on white card]; "Holotypus" [handwritten by Harz on red card]. The tarsi of all of the left legs are missing. The right hind leg is glued to a card mount and there is a micro tube with dissected genitalia secured through the stopper, both on the original pin. Box Harz 41.

Glandulosa kinzelbachi Harz 1979

kinzelbachi Harz, 1976a: 56 [*Mogoplistes*].

Karpathos. ♂ Holotype, 6 ♂ paratypes and 13 ♀ paratypes.

The holotype and eighteen paratypes in the MHNG collection are currently on loan. According to the original description one ♀ paratype was deposited in the collection of H. Pieper of Kiel. Alcohol collection.

Mogoplistes kinzelbachi Harz, 1976

kisi Harz, 1967a: 98-100 [*Conocephalus*].

Albanien, Elbasan. ♂ Holotype, 2 ♂ paratypes and 2 ♀ paratypes.

The MHNG collection has one ♂ and one ♀ labelled as paratypes, but these specimens were captured in Greece and are not part of the type series. The ♂ holotype is in the NHMW, as stated in the original description, with two ♂ and three ♀ specimens labelled as paratypes. It is not clear whether any of these were added after the publication of the description (and are thus not part of the type series) or if the number of specimens examined given in the original description was incorrect. Box Harz 9a.

Conocephalus kisi kisi Harz, 1967

kisi gaukleri Harz, 1969a: 114 [*Conocephalus*].

Ladakia [country uncertain]. ♂ Holotype, 1 ♂ paratype and 2 immature ♀ paratypes.

No specimens found in the MHNG. The holotype was from the collection of Brunner von Wattenwyl, and is in the NHMW, along with one ♂ and two ♀ specimens labelled as paratypes.

Conocephalus kisi gaukleri Harz, 1969

knipperi Harz, 1982b: 231-234 [*Omocestus*].

Spanien, Cala Jostel. 1 ♂ syntype and 2 ♀ syntypes.

No specimens found in the MHNG collection. Harz did not designate a holotype and so the three type specimens, which are stated to be in the SMNK in the original description, should be considered syntypes.

A junior synonym of *Omocestus minutissimus* (Brullé, 1832)

krahmeri Harz, 1978a: [*Grusia*].

SSSR [sic], Georgien, Tbilissi. ♀ Holotype.

Holotype ♀ with labels: "C.C.C.P., Georgien, Tbilissi, 8.vii.1976, am Schildkrötensee leg. L. KRAHMER" [handwritten by Harz on white card]; "Holotypus" [handwritten by Harz on red card]; "Grusia krahmeri spec. n. det. Kurt HARZ 1979" [handwritten by Harz on white card with "det. Kurt HARZ 1979" printed]. Specimen set with right wings spread and left wings folded. The last tarsal segment of the left hind leg is missing. Box Harz 83.

A junior synonym of *Pseudoceles oedipodiooides* Bolivar, 1899

lagrecai Harz, 1975d: 889-890 [*Chorthippus*].

[Greece] Dephi. ♂ Holotype, 26 ♂ paratypes and 22 ♀ paratypes.

Holotype ♂ with labels: "18.10.69, Δελφοί, leg. Chr. Walther" [handwritten on white card with "leg. Chr. Walther" printed]; "Chorthippus lagrecai spec. n. K. HARZ det." [printed on white card]; "HOLOTYPE" [printed on red card]. Specimen set with right wings spread and left wings folded. The tarsi of the left front leg and the last tarsal segment of the left hind leg are missing. The end of the abdomen is detached and glued to a card mount secured on the original pin, a second card mount, also on the original pin, carries dissected parts. Also present are 24 ♂ paratypes and 19 ♀ paratypes, one labelled as allotype. According to the original description two ♂ paratypes and two ♀ paratypes were deposited in the ZMHB.

A junior synonym of *Chorthippus bornhalmi* Harz, 1971

lodosi Harz, K. 1975b: 9-14 [*Poecilomon*].

Türkei, Manisa. ♂ Holotype and 1 ♂ paratype.

Holotype ♂ with labels: "Manisa, 2.6.1972, Y.of" [handwritten on white card]; "Poecilimon lodosi n. spec. det. K. HARZ" [handwritten by Harz on white card]; "HOLOTYPE" [printed on pink card]. The claws of the right front and left hind legs, and the last tarsal segment of the right hind leg are missing. The paratype is stated in the original description to have been deposited in the collection of N. Lodos, who collected the specimens. Images on OSF. Box Harz 7.

Poecilimon lodosi Harz, 1975

maculatus australis Harz, 1975d: 804 [*Myrmyleotettix*].

Sierra Nevada. ♀ Holotype.

No specimens found in the MHNG collection. The ♀ holotype is in the NHMW, as stated in the original description.

A junior synonym of *Myrmeleotettix maculatus maculatus* (Thunberg, 1815)

maculatus hackeri Harz, 1987a: 403-405 [*Myrmeleotettix*].

Phalakron Oros, Chionotrypa, Griechenland. ♂ Holotype and 1 ♂ paratype.

Holotype ♂ with labels: "N Griechenland, Phalakron Oros, Chionotrypa, 1700m, 1.9.1985, leg. Hacker 8511" [printed on white paper with "8511" handwritten]; "Holotypus" [handwritten by Harz on red card]; "Myrmeleotettix maculatus hackeri n. ssp. K. HARZ det." [handwritten by Harz on white card]. Specimens set with wings folded. The left hind leg is missing, the left front leg, which lacks the last tarsal segment, and right hind leg are detached and glued to a card mount secured on the original pin. A second card mount on the same pin has the end of the left antenna glued to it. A ♂ with the same data and labelled as paratype is also in the MHNG collection. Box Harz 119.

Myrmeleotettix maculatus hackeri Harz, 1987

maculatus hispanicus Harz, 1975d: 805 [*Myrmeleotettix*].

Val de Ordesa, Aragonien. ♂ Holotype, 9 ♂ paratypes and 8 ♀ paratypes.

Holotype ♂ with labels: "HISPANIA, Val de Ordesa, 29-31.8.-1.9.1972 K. Harz et al. leg." [printed on white card]; "Holotypus" [printed on red card]; "Myrmeleotettix maculatus hispanicus n. ssp. det. K. HARZ" [handwritten by Harz on white card]. Specimen set with wings folded. The tibia and tarsi of the right hind leg are missing. There are 19 specimens labelled as allotype or paratype in the MHNG collection, all with the same label data as the holotype, suggesting that the number of specimens examined given in the original description was erroneous. Box Harz 119.

A junior synonym of *Myrmeleotettix maculatus maculatus* (Thunberg, 1815)

major muchei Harz, 1963: 195-197 [*Isophya*].

Taurus, Bolghar-Dagh, Berendi. 3 ♂ syntypes and 4 ♀ syntypes.

One ♂ syntype and one ♀ syntype. A ♂ with labels: "Anatolia / Mai, Toros Dagh, Berendi leg. Muche" [printed on white card]; "Isophya major muchei [sic] Harz ♂ det. Kurt Harz" [handwritten by Harz on white card with "det. Kurt Harz" printed]; "Paratypus" [handwritten on red card]; "Syntypus" [printed on red paper]. Both antennae, the tibia and tarsi of the left front leg, the tarsi of the right front leg, the tarsi of the left middle leg, two tarsal segments of the right middle leg, the last tarsal segment of the right hind leg and the entire left hind leg are missing. The tibia of the left middle leg is detached and glued to the determination label. The abdomen has

been eviscerated and stuffed. A ♀ with labels: "Anatolia / Mai, Toros Dagh, Berendi leg. Muche" [printed on white card]; "Isophya major muchei [sic] Harz ♂ det. Kurt Harz" [handwritten by Harz on white card with "det. Kurt Harz" printed]; "Paratypus" [handwritten on red card]; "Syntypus" [printed on red paper]. The entire right front leg, the claws of both middle legs and the last tarsal segment of both hind legs are lost. The abdomen has been eviscerated and stuffed. Harz did not designate a holotype or state where the specimens were deposited; the whereabouts of the other syntypes is unknown, but W. Muche's collection is in the SMTD. Box Harz 3.

A junior synonym of *Isophya major* Brunner von Wattenwyl, 1878

meadowsae Harz, 1970a: 196-198 [*Conocephalus*].

Dioura, Mali. ♂ Holotype and 17 paratypes (sex not specified for all specimens).

The MHNG collection has one ♂ and one ♀ paratype. The holotype and the other paratypes are in the BMNH collection (images on OSF) as stated in the original description. Box Harz 10.

Conocephalus meadowsae Harz, 1970

mollis reissingeri Harz, 1972: 130 [*Chorthippus*].

Spanien, Puerto de la Carrasque. 2 ♂ syntypes.

One ♂ syntype with labels: "Hispania, Umgeb. Alicante, Peñorroja de Jijona, 800m, S-Hang, 18.ix.1971, E. REISSINGER 1971" [handwritten by Harz on White card]; "Chorthippus mollis reissingeri n. ssp. det. K. HARZ" [handwritten by Harz on white card]; "Chorthippus reissingeri HARZ, K. HARZ det." [printed on white card]; "HOLOTYPE" [printed on red card]. Specimen set with right wings spread and left wings folded. The right antenna, the left front leg and the tarsi of the right front and middle legs are missing. A micro-tube with dissected parts is secured through the stopper on the original pin. Although the locality given in the description does not appear to match the data label of the specimen except for the date, there is a mountainous ridge called the Carrasqueta overlooking Jijona. There are 14 ♂ and four ♀ specimens labelled as allotype and paratypes, but these were collected after the publication of the description and are therefore not part of the type series. This is also true of the specimens labelled as paratypes in the SMFD (images on OSF). The whereabouts of the second syntype is unknown.

Chorthippus reissingeri Harz, 1972

muchei Harz, 1978b: 58-59 [*Oedipoda*].

Tadzhikistan, Pamir, Roschkala. ♀ Holotype and 1 ♀ paratype.

Holotype ♀ with labels: "Pamir – linkes Ufer Schahdara b. Roschkala 19.7.1977" [handwritten on white card, the year added in different ink]; "Oedipoda muchei sp. n. det. K. HARZ" [handwritten by Harz on white card]; "Holotypus" [handwritten by Harz on red card].

Specimen set with right wings spread and left wings folded. The last tarsal segment of the right front leg and the claws of the left front and left hind legs are lost. The ♀ paratype is also present. Box Harz 81b.

Oedipoda muchei Harz, 1978

musicus Harz, 1978e: 91-92 [*Tridactylus*].

Jordanien, M'an [sic], Petra. ♂ Holotype, 1 ♂ paratype and 1 ♀ paratype.

Holotype ♂ with labels: "Jordanien, Ma'an, Petra, Wadi Musa unterhalb Forum 17.3.1977 Reg. N. 30c W. SCHMIDT, F. KRUPP" [handwritten by Harz on white card]; "Tridactylus musicus sp. n. det. K. HARZ" [handwritten by Harz on white card]; "Holotypus" [handwritten by Harz on red card]; "Tridactylus pfaendleri HARZ det. 1980" [handwritten by Harz on white card]. The specimen is card mounted; the right fore wing and the right middle and hind legs are detached and glued to the mount. There is a micro-tube with dissected parts secured through the stopper on the original pin. Also present are a ♂ and a ♀ with the same data labelled as paratypes. *T. musicus* Harz is a junior homonym of *T. musicus* Tindale, 1928 and Harz proposed the replacement name *T. indistinctus* Harz, 1979. Box Harz 46.

A junior synonym of *Xya pfaendleri pfaendleri* (Harz, 1970)

nadigi Harz, 1987b: 51-54 [*Arcyptera*].

Maroc, Dievlets. ♂ Holotype, 1 ♂ paratype and 4 ♀ paratypes.

Holotype ♂ with labels: "MAROC, Marr., Diebilets, 19.-23.IV.67 leg. Nadig" [handwritten by Nadig on white card with "leg. Nadig" printed]; "MHNG coll. Nadig" [printed on white paper]; "Nadigia nadigi n. sp. ♂ Kurt HARZ det" [handwritten by Harz on white card]; "Holotypus" [handwritten by Nadig on red card]. Specimen set with right wings spread and left wings folded. The right antenna, the right front leg and the last tarsal segment of the left front leg are missing. The right hind leg is detached and glued to a card mount secured on the original pin. The holotype and three ♀ paratypes, one labelled as allotype, are in the MHNG Nadig collection, and a pair of paratypes is in the Harz collection. Boxes Nadig 633 and Harz 103b.

Adolfius nadigi (Harz, 1987)

nadigi Harz, 1987c: 61-63 [*Omocestus*].

Algerien, Aurès, Dj. Mahmal. ♂ Holotype and an unspecified number of ♂ and ♀ paratypes.

Holotype ♂ with labels: "ALGERIE ALG.79:47 Aurès: Dj. Mahmel, SE-Hang 1650-1800m, 10.7.79 leg. Nadig" [printed on white card]; "Genit. extrah." [printed on white card]; "MHNG coll. Nadig" [printed on white paper]; "Omocestus Nadigi n. sp. Kurt HARZ det" [handwritten on white card with "Kurt HARZ det" printed]; "HOLOTYPE" [printed on red card]. Specimen set with the left wings folded. The left antenna,

left middle leg right middle leg and left hind leg are missing. The right antenna, right wings and genitalia are glued to a card mount secured on the original pin. There are eighteen ♂ and sixteen ♀ paratypes, one labelled as allotype, in the Nadig collection and two ♂ paratypes and one ♀ paratype in the Harz collection. Boxes Nadig 668 and Harz 105b.

Omocestus nadigi Harz, 1987

newmanae Harz, 1969b: 707-710 [*Discotila*].

Epirus, Paraskevi. Unspecified number of ♂ and ♀ syntypes.

No specimens found in the MHNG. The original description does not list the number of specimens seen, although both ♂ and ♀ characters are illustrated. The NHMW, in which the type series was deposited according to the original description, has four specimens labelled as holotype and paratypes. These specimens are nevertheless syntypes because the original description does not designate a holotype.

Ovaliptila newmanae (Harz, 1969)

ornatus hoelzeli Harz, 1966b: 23-24 [*Poecilimon*].

Mala Rupa, Macedonien. ♂ Holotype and 1 ♂ paratype. No specimens found in the MHNG collection. According to the original description the type specimens were deposited in the ZSMC.

Poecilimon hoelzeli Harz, 1966

pedestris nadigi Harz, 1975b: 14 [*Podisma*].

Passo Croce Domini-Gio. ♂ Holotype, 1 ♂ paratype and 2 ♀ paratypes.

Holotype ♂ with labels: "P. Croce 71:64 Domini-Gio. Bala, 2000-2050m, 8.9.71 leg. Nadig" [handwritten by Nadig on white card with "leg. Nadig" printed]; "Podisma pedestris nadigi n. ssp. K. HARZ det." [handwritten by Harz on white card]; "HOLOTYPE" [printed on red card]. There is a micro-tube with dissected parts secured through the stopper on the original pin. There is a ♀ paratype labelled as allotype in the Nadig collection and a ♂ and a ♀ paratype in the Harz collection. The Nadig collection also has a series of specimens with the same data labelled as paratypes, but these were not seen by Harz (the original description mentions only two ♂ and two ♀) and are not part of the type series. Boxes Nadig 432 and Harz 54.

Podisma pedestris nadigi Harz, 1971

peneri Harz, 1970a: 198 [*Leptophyes*].

Forest near Massada, Golan Heights. ♂ Holotype, 2 ♂ paratypes and 3 ♀ paratypes.

The MHNG collection has one ♂ paratype and one ♀ paratype. There are two paratypes in the BMNH (images on OSF). According to the original description the holotype and another paratype were deposited in the collection of the Hebrew University in Jerusalem. Box Harz 5.

Leptophyes peneri Harz, 1970

pfaendleri Harz, 1991: 1 [*Tettigonia*].

Bulgarien, Sakar. ♀ Holotype and 1 ♀ paratype.

Holotype ♀ with labels: "5.7.88, BULGARIEN, SAKAR, GEBDRIPSCHÉWO" [handwritten on whitish paper]; "Tettigonia pfaendleri n. sp. K. HARZ det." [handwritten by Harz on white card]; "Holotypus" [handwritten by Harz on red card]. Specimen set with wings folded. The last tarsal segment of the left middle leg is missing. There is another ♀ with the same data labelled as paratype in the MHNG collection. It is not clear whether this name is available because the description was printed in a newsletter that may not be a valid publication under the IZN (Ingrisch & Willemse, 2004). The name is treated as a nomen nudum on OSF. Box Harz 11b.

Tettigonia pfaendleri Harz, 1991

pfaendleri Harz, 1970b: 56-59 [*Tridactylus*].

Österreich, Neusiedler See. ♀ Holotype, 8 ♂ paratypes and 30 ♀ paratypes.

The MHNG collection contains one ♂ paratype and three ♀ paratypes. The ♀ holotype and a ♂ labelled as allotype are in the NHMW, as stated in the original description, but the other paratypes meant to be present could not be identified. The specimens in the SMFD illustrated on OSF are not from a locality mentioned in the description and are thus not part of the type series despite having been labelled as such. Box Harz 46.

Xya pfaendleri pfaendleri (Harz, 1970)

pfaendleri palestinae Harz, 1971b: 342 [*Tridactylus*].

Palästina, Khudeira bei Haifa. ♂ Holotype, 2 ♂ paratypes and 2 ♀ paratypes.

There is a pair of paratypes in the MHNG. The ♂ holotype is in the NHMW, as stated in the original description, accompanied by a ♀ labelled as allotype and a ♀ labelled as a paratype. Box Harz 46.

Xya pfaendleri palaestinae (Harz, 1971)

pieperi Harz, 1979a: 106 [*Gryllomorpha*].

Kos. ♀ Holotype.

No specimens found in the MHNG. According to the original description the holotype, preserved in alcohol, was deposited in the collection of H. Pieper of Kiel.

Gryllomorpha dalmatina peiperi Harz, 1979

poneli Harz & Voisin, 1987: 373-375 [*Rhacocleis*].

Frankreich, Hyeres, Le Ceinturon. ♂ Holotype, 1 ♂ paratype and 3 ♀ paratypes.

There are a ♂ and a ♀ paratype in the MHNG collection. According to the original description the holotype and two ♀ paratypes were deposited in the collection of Philippe Ponel, where they remain (Ponel, pers. comm.). Box Harz 28.

Rhacocleis poneli Harz & Voisin, 1987

raggei Harz, 1970a: 194-195 [*Conocephalus*].

Lake George, Uganda. ♂ Holotype and 36 paratypes (sex not specified for all specimens).

The MHNG collection has two ♂ paratypes and two ♀ paratypes. The holotype and the other paratypes are in the BMNH (images on OSF and type material indicated on their online database) as stated in the original description. Box Harz 10.

A junior synonym of *Conocephalus laetus* (Redtenbacher, 1891)

rammei Harz, 1973c: [*Odontopodisma*].

Fiume. ♂ Holotype, 3 ♂ paratypes and 3 ♀ paratypes. There is one ♂ paratype in the MHNG collection. The ♂ holotype is in the NHMW, as stated in the original description, as are two paratypes. The whereabouts of the other paratypes is unknown. Box Harz 57a.

Odontopodisma rammei Harz, 1973

raymondi africanus Harz, 1970b: 59 [*Omocestus*].

Marokko, Atlas, Arround. ♂ Holotype, 6 ♂ paratypes and 7 ♀ paratypes.

There are a ♂ and a ♀ placed under this name in the MHNG, both labelled as paratypes. The data labels do not correspond exactly to the information given in the original description and they are probably not part of the type series. The ♂ holotype is in the NHMW, as stated in the original description, as is a ♀ labelled as allotype and 22 other specimens marked with a disk of yellow paper which presumably include the other paratypes.

Omocestus africanus Harz, 1970

rubioi Harz, 1973a: 244-245 [*Eumigus*].

Mulhacen, Granada. 3 ♀ syntypes.

A ♀ syntype with labels: "MULHACEN 3,400m (Granada) 20.7.1970 Dr. Fidel Fdez. Rubio" [printed on white card with "20.7" and "70" handwritten]; "Eumigus rubioi n. sp. det. K. HARZ" [handwritten by Harz on white card with "det. K. HARZ" printed]; "HOLOTYPE" [printed on red card with "HOLO" inked over]. The right antenna, both front legs, both middle legs, the tibia and tarsi of the left hind leg and two tarsal segments of the right hind leg are missing. The remaining legs have been reattached with glue. A ♀ syntype with labels: "MULHACEN 3,400m (Granada) 20.7.1970 Dr. Fidel Fdez. Rubio" [printed on white card with "20.7" and "70" handwritten]; "Eumigus rubioi n. sp. det. K. HARZ" [handwritten by Harz on white card with "det. K. HARZ" printed]; "HOLOTYPE" [printed on red card with "HOLO" inked over]. Both antennae, the left front leg, the tarsi of the right front leg and two tarsal segments of the right middle leg are missing. A ♀ syntype with labels: "MULHACEN 3,400m (Granada) 20.7.1970 Dr. Fidel Fdez. Rubio" [printed on white card with "20.7" and "70" handwritten]; "Eumigus rubioi n. sp. det. K. HARZ" [handwritten by Harz on white card with "det. K. HARZ" printed]; "HOLOTYPE" [printed on red card with "HOLO" inked over]. The left antenna, right front leg, both middle legs and left hind leg are lost. Although Harz refers to a holotype, he did not designate an

individual in the description, and as all three specimens are labelled as "Type" they must be considered syntypes. Box Harz 48.

Eumigus rubioi Harz, 1973

schulmeisteri Harz, 1992: 11-13 [*Schulmeisteri*].

Türkei, Süvarihalil Geçidi. ♂ Holotype.

Holotype ♂ with labels: "Türkei, Süvarihalil Geçidi osts., 2400m, 14.985/16, leg. Hacker" [handwritten by Harz on white card]; "Schulmeisteri n. gen. schulmeisteri n. sp. Kurt HARZ det" [handwritten by Harz on white card with "Kurt HARZ det" printed]; "Holotypus, n. gen + n. spec. Schulmeisteri K. HARZ" [handwritten by Harz on red paper]. Both antennae, the last tarsal segment of the left front leg, the entire right front and both middle legs and the tibia and tarsi of the left hind leg are missing. The left front leg has been reattached with glue. The right hind leg, which lacks the proximal part of the femur and the tarsi, is detached and glued to a card mount secured on the original pin. The femur of the left hind leg is damaged. Dissected genitalia are glued to a second card mount also secured on the original pin. It is not clear whether this name is available because the description was printed in a newsletter that may not be a valid publication under the ICBN (Ingrisch & Willemse, 2004). This species is treated as a nomen dubium by Ünal (2011) and on OSF, but this may be incorrect because it implies valid publication. Box Harz 162.

Schulmeisteri schulmeisteri Harz, 1992

starcki Harz, 1985a: 183-185 [*Sphodromerus*].

Jordanien, Dhawi unter 51, leg. Starck. ♀ Holotype.

Holotype ♀ with labels: "No. 51, Jordanien, Dhawi Gebiet, Okt. 1983, M. Stark leg." [handwritten by Harz on white card]; "Holotypus" [handwritten by Harz on red card]; "Sphodromerus kaltenbachii [sic] n.sp. Kurt HARZ det." [handwritten by Harz on white card with "Kurt HARZ det." Printed]; "Type of S. starcki! Hollier, 2014" [handwritten on red paper]. Specimen set with right wings spread and left wings folded. The last tarsal segment of the left front and right hind leg are missing. The tips of the right wings are lost. Although the name on Harz's identification label is different, there can be no doubt about the identity of the specimen as the holotype. Box Harz 64.

Sphodromerus starcki Harz, 1985

stigmaticus faberi Harz, 1975d: 769 [*Stenobothrus*].

Hannover, Celle, leg. Bornhalm. ♂ Holotype and 1 ♀ paratype.

Holotype ♂ with labels: "Hannover, Celle/Wietzenbrück, 15.viii.1970, BORNHALM" [handwritten by Harz on white card]; "Holotypus" [printed on red card]; "Stenobothrus stigmaticus faberi n. ssp. det. K. HARZ" [handwritten by Harz on white card with "det. K. HARZ" printed]. Specimen set with right wings spread and left wings folded. Both antennae, the last tarsal segment of

the right middle leg and the entire right hind leg are lost. The MHNG collection has 17 other specimens labelled as paratypes but these are not mentioned in the original description and cannot be considered part of the type series. The specimens in SMFD labelled as paratypes and illustrated on OSF are likewise not referred to in the original description and are not part of the type series. Box Harz 115a.

Stenobothrus stigmaticus faberi Harz, 1975

†*strausi* Harz, 1973a: 245 [*Calliptamus*].

Willaershausen. One specimen.

No specimens found in the MHNG. According to the original description the holotype (specimen no. 20690) was deposited in the Georg-August-Universität in Göttingen.

† *Calliptamus strausi* Harz, 1973

syriaca Harz, 1979a: 103-106 [*Gryllomorpha*].

Syrien, 64km östlich von Homs. ♂ Holotype, 5 ♂ paratypes, 10 ♀ paratypes and 1 immature paratype.

Holotype ♂ with labels: "Syrien, Homs-Palmyra 64km E Homs, 12.3.1977, No. 21 Nahustexk. R: KINZELBCH et al" [handwritten by Harz on white card]; "Gryllomorpha syriaca sp. n. det Kurt HARZ 1979" [handwritten by Harz on white card with "det Kurt HARZ 1979" printed]; "Holotypus" [handwritten by Harz on red card]. The tarsi of the left front leg, the last tarsal segment of the left hind leg and two tarsal segments of the right hind leg are missing. There are two ♂ and three ♀ specimens with the same data and labelled as allotype and paratypes in the MHNG dry collection. Gorochov (2009) considered that a damaged ♀ labelled as a paratype probably belongs to a different species. The remaining paratypes are in alcohol. Box Harz 40 & alcohol collection.

Gryllomorpha syriaca Harz, 1979

szijii Harz, 1982a: 229-230 [*Chorthippus*].

Marokko, Timehdit. ♂ Holotype, 2 ♂ paratypes and 2 ♀ paratypes.

There are a ♂ paratype and a ♀ paratype in the MHNG. According to the original description the holotype and two paratypes were deposited in the collection of the late Josef Szijj who had collected them. Box Harz 157b.

Chorthippus szijii Harz, 1982

tsirojanni Harz & Pfau, 1983: 33-35 [*Metrioptera*].

Griechenland, Olympos-Gebirge, Ag. Dimitrios. ♂ Holotype and 1 ♀ paratype.

No specimens found in the MHNG. According to the original description the type specimens were deposited in the collection of H. K. Pfau, who had collected them. *Metrioptera tsirojanni* Harz & Pfau, 1983

tucherti Harz, 1988b: 133-135 [*Eupholidoptera*].

Türkei, Dalyan, Muğla, Strand bei Iztuzu. ♂ Holotype and 1 ♂ paratype.

Although the original description states that the type specimens were deposited in Harz's collection no specimens could be found in the MHNG. The whereabouts of the type specimens is unknown.

Eupholidoptera tucherti Harz, 1988

tuerki orientalis Harz, 1979c: 128 [Tetrix].

Tadzhikistan, 16km östlich von Isfara. ♂ Holotype, 1 ♂ paratype and 1 immature paratype.

Holotype ♂ with labels: "Tadzhikistan, 16km E Isfara, 1050m, 10.5.1979 W. H. MUCHE" [handwritten by Harz on white card]; "HOLOTYPE" [printed on red card]; "Tetrix tuerki orientalis sub sp. n. K. HARZ det." [handwritten by Harz on white card]. Specimen set with wings folded. The right antenna is missing. There are two specimens with the same data labelled as paratypes in the MHNG. Box Harz 45a.

Tetrix tuerki orientalis Harz, 1979

vicheti Harz, 1971b : 340-342 [Tridactylus].

Angola, Cazombo. ♂ Holotype and 1 ♂ paratype.

There is a ♂ paratype in the MHNG. According to the original description the holotype was deposited in the MNHN. Box Harz 46.

Xya vicheti (Harz, 1971)

waltheri Harz, 1973b: 345 [Epipodisma].

Frankreich, Turge de la Suffie. ♂ Holotype, 5 ♂ paratypes and 4 ♀ paratypes.

Holotype ♂ with labels: "viii.1966 Turge de la Suffie, ca. 2500m Obb.leg. Walther" [handwritten on white card with "Obb.leg. Walther" printed]; "Epipodisma waltheri n. sp. det. K. HARZ" [handwritten by Harz on white card]; "Holotypus" [handwritten by Harz on red card]. Most of the right antenna is missing. There is a microtube with dissected parts secured through the stopper on the original pin. A further three ♂ and two ♀ with the same data and labelled as allotype and paratypes are present. According to the original description two ♂ and two ♀ paratypes were deposited in the collection of C. Walther; these specimens are now in the SMFD (images on OSF). Box Harz 55.

Epipodisma pedemontana waltheri Harz, 1973

waltheri Harz, 1966c: 81-83 [Platycleis].

Mornas bei Orange, Vaucluse, Frankreich. ♂ Holotype and 1 ♀ paratype.

Holotype ♂ with labels: "28.8.62, Mornas bei Orange Fr. Obb.leg. Walther" [handwritten on white card with "Obb. leg. Walther" printed]; "Holotypus" [handwritten by Harz on red card]; "Platycleis waltheri Harz ♂" [handwritten by Harz on white card]. Specimen set with wings folded. Most of the right antenna, the last tarsal segment of the right front leg and the last tarsal segment of both hind legs are missing. Dissected genitalia are glued to a card mount secured on the original pin. The ♀ paratype is also in the MHNG collection. Images on OSF. Box Harz 17.

Platycleis waltheri Harz, 1966

willemsei Harz, 1971a: 335 [Chorthippus].

Griechenland, Kalavrita Chelmos. ♂ Holotype and 152 paratypes.

There are 16 specimens labelled as paratypes in the MHNG. According to the original description two paratypes were deposited in the BMNH and the rest of the type specimens were deposited in the collection of F. Willemse, which is now in the RMNH. Boxes Harz 121 and Nadig 812.

Chorthippus willemsei Harz, 1971

Other Names

The Harz collection contains several other specimens labelled as types, but these names do not appear to have been published and are therefore unavailable. As noted by Heller (1998), the names *Chorthippus longicornis geriberti* Harz, 1962 and *Platycleis escalerae graeca* Harz, 1966a are unavailable because they were explicitly described as forms and not as subspecies.

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Taxonomic considerations on *Lobocneme* Rehn, 1911 and *Paroxyopsis* Rehn, 1911 and a new synonymy (Insecta Mantodea: Stagmatopterinae)

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Abstract: The authors, on the basis of new morphological data, consider the genus *Paroxyopsis* Rehn, 1911 a junior synonym of *Lobocneme* Rehn, 1911 and they transfer to this latter genus the species currently attributed to *Paroxyopsis*: *Lobocneme icterica* (Saussure & Zehntner, 1894) n. comb.

Keywords: Mantodea, Mantidae, Stagmatopterinae, new synonymy, new combination, South America.

INTRODUCTION

During the revision of the genus *Parastagmatoptera* Saussure we found two females from Isla El Rosario (Colombia), identified by Beier as *Parastagmatoptera* n. sp. and currently deposited in the Naturhistorisches Museum Wien (NHMW) (coll. Stocker) (Fig. 8). The examination of the two specimens showed the presence of a small lobe on the middle and hind femora, which is not a characteristic of the genus *Parastagmatoptera* while it is typical of the related but little known genus *Lobocneme* created by Rehn (1911) for *Parastagmatoptera lobipes* Redtenbacher, 1892 and to which the two specimens are attributable. Rehn in the same work also erected the genus *Paroxyopsis*, for *Oxyops icterica* Saussure & Zehntner, 1894 from South America, which in his opinion differed from *Lobocneme* by the presence of the lobe only on the hind femora; this fact caught our attention and, having had the possibility to examine the types relative to two genera, we realized that:

- It is not true that in the genus *Paroxyopsis* the lobes are found only on the hind femora; the typus, even if it is damaged, still retains the middle left femur and the hind right femur and it can be seen that both are lobed as in *Lobocneme*.
- The shape of the eyes, the shape and length of the pronotum and the black stripe on the inner surface of the fore coxae are shared by both genera.

The reason Rehn believed that in *Paroxyopsis* only the hind femora were lobed might be due to the fact that he did not see the typus of *P. icterica*, but only referred to the original description, mistakenly interpreting what Saussure and Zehntner wrote regarding the lobe of the femora. In fact, the sentence "*femorum posticorum ca-*

rina infera apice lobato minimo" was interpreted as if only the hind femora presented a lobe. But, as it can be deducted further on in the same article, the authors used the same sentence for the genus *Phyllovates* which, as it is known, presents middle and hind lobed femora.

In conclusion, since there is not any difference between the two genera with respect to the number of lobed femora, they must be treated as synonyms. Therefore, in accordance with the principle of priority (23.1 and 23.3) of the ICBN, *Lobocneme* is the valid name and *Paroxyopsis* is a new synonym of it. Consequently the following three species: *L. lobipes* (Redt.), *L. colombiae* (Heb.) and *L. icterica* (Sauss. & Zehnt., **n. comb.**) must be ascribed to genus *Lobocneme*.

MATERIAL AND METHODS

This study is based on the holotypes of: *Oxyops icterica*, deposited at the Muséum d'Histoire Naturelle de Genève (MNHG); *Parastagmatoptera lobipes* deposited at the Natural History Museum, London-UK (BMNH) and additional specimens deposited in the following collections: Academy Natural Sciences Philadelphia (ANSP), Naturhistorisches Museum Wien (NHMW) and Museum of Animal Biology of Catania (MDAB).

The measurements were taken under a dissecting microscope using an ocular eyepiece with a scale bar. The following measurements were taken: total length of the body, measured from head to tip of abdomen; width head, measured from between the lateral margins of the eyes; pronotal length measured from the anterior margin to posterior margin of pronotum; length of metazona measured from the supracoxal sulcus to posterior margin of pro-

notum; supracoaxal dilation width measured between the lateral margins of supracoaxal sulcus; pronotal minimum width; coxal length measured from the coxal insertion to external margins of distal lobes; femoral length measured from the basal apex to external margin of the geniculare lobe; femoral maximum width; length tegmina measured from the thoracic insertion to distal margin. Anatomical terminology followed Snodgrass (1935), except for the copulatory apparatus that followed La Greca (1954).

The study of morphology was carried out using a stereoscopic microscope Leica MZ 12, with a micrometric ocular and a camera lucida attached. Images of the relevant structures were obtained through a stereoscopic microscope Leica MZ 205A (equipped with the software Leica Application Suite v. 4.2.0).

In order to avoid repetitive typing, we provide a spination formula for the legs, as first introduced by Rivera (2010a).

TAXONOMY

Genus *Lobocneme* Rehn, 1911

Lobocneme Rehn, 1911: 10.

Paroxyopsis Rehn, 1911: 8 (n. syn.).

Lobocneme. – Giglio-Tos, 1914: 37. – Giglio-Tos, 1927: 600. – Beier, 1964: 950. – Terra, 1995: 68. – Cerdà, 1997: 22. – Ehrmann, 2002: 208. – Otte & Spearman, 2005. – Agudelo *et al.*, 2007: 110.

Paroxyopsis. – Giglio-Tos, 1914: 19. – Giglio-Tos, 1927: 588. – Beier, 1964: 950. – Terra, 1995: 68. – Ehrmann, 2002: 275. – Otte & Spearman, 2005. – Agudelo *et al.*, 2007: 110.

Type species: *Parastagmatoptera lobipes* Redtenbacher, 1892 by monotypy.

Diagnosis: Mantises of medium size (length of body from head to tip of abdomen between 30–32 mm) with a general ochre appearance. Both sexes are fully winged, these are hyaline in the male, opaque and coloured in the female. Pronotum elongated; fore coxae far shorter than the metazona and with an internal basal black strip (Figs 1–2); middle and hind femora with a small apical lobe. Spination formula F=15IS/5ES/4DS and T=14IS/11ES. External genitalia, with phalloid apophysis (Figs 3–4) constituted by a broader anterior branch and an elongated posterior branch; ventral phallomere directed downwards (Fig. 5).

Remarks: *Lobocneme* is the best candidate to be the sister genus of *Parastagmatoptera* recently revised by Lombardo *et al.* (2014), because it shares the same shape of the pronotum, the black spot on the inner surface of the fore coxae and the same structural model of the external male genitalia. It can be distinguished based on its middle and hind femora that have a small lobe on the apical portion of the posterior ventral carina.

Lobocneme lobipes (Redtenbacher, 1892)

Figs 1–5, 6A–C

Parastagmatoptera lobipes Redtenbacher, 1892: 206.

Parastagmatoptera lobipes. – Brunner, 1893: 605. – Saussure & Zehntner, 1894: 189. – Kirby, 1904: 299. – Rehn, 1905: 177.

Lobocneme lobipes. – Rehn, 1911: 11. – Giglio-Tos, 1914: 37. – Giglio-Tos, 1927: 600. – Beier, 1964: 950. – Terra, 1995: 68. – Ehrmann, 2002: 208. – Otte & Spearman, 2005: pp. – Agudelo *et al.*, 2007: 110.

Typical material examined: BMNH; holotype male of *Parastagmatoptera lobipes* from St. Vincent (Lesser Antilles).

Additional material examined: MDAB; 1 male; St Vincent, Kingstown 15.5.1937 (coll. Lombardo).

Note: This species has been described and illustrated by Redtenbacher (1892) based on a male from the island of St. Vincent (Fig. 6A–C) and currently deposited in the Natural History Museum London (BMNH); the year after, Brunner v. Wattenwyl (1893) also furnished a brief description and illustration of the female from island of Grenada (Lesser Antilles). We examined a male from the same locality of the holotype, currently deposited in the Museum of Animal Biology of Catania (MDAB) and we consider it useful to describe and figure the male genitalia that have been unknown until today.

External genitalia: ventral phallomere (Fig. 5) broader than long, median lobe well developed; distal process with acuminate apex directed downwards to right. Phalloid apophysis (Figs 3–4) with anterior branch enlarged with small granules, posterior branch narrower shorter and folded to right, apex exhibit sparse small spines.

Distribution: This species occurs in islands of Saint Vincent and Grenada in the west (Lesser) Antilles.

Lobocneme icterica (Saussure & Zehntner, 1894)

n. comb.

Fig. 7

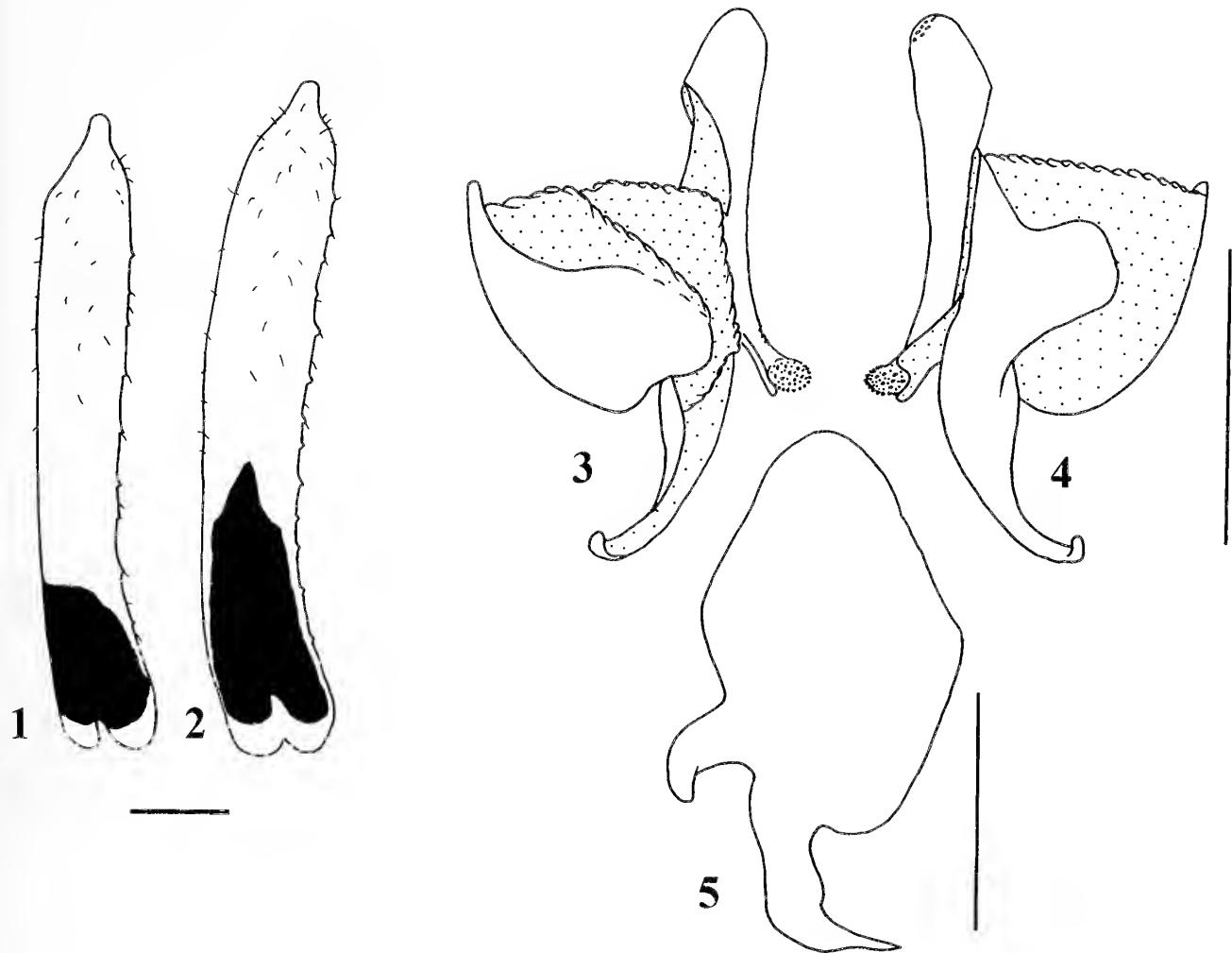
Oxyops icterica Saussure & Zehntner, 1894: 190.

Oxyops icterica. – Kirby, 1904: 298.

Paroxyopsis icterica. – Rehn, 1911: 8. – Giglio-Tos, 1914: 19. – Giglio-Tos, 1927: 588. – Beier, 1964: 950. – Terra, 1995: 68. – Ehrmann, 2002: 275. – Otte *et al.*, 2005. – Agudelo *et al.*, 2007: 125.

Type material examined: MNHG; holotype female of *Paroxyopsis icterica* from South America.

Remarks: This species is known only from the female holotype (Fig. 7), originating from an unspecified area of South America, deposited in the Muséum d'Histoire Naturelle de Genève (MHNG). It is generally in fair condition, with only some damage to the anal area of the mesothoracic wings; the right middle leg and the left hind leg are missing.



Figs 1-5. *Lobocneme lobipes*: (1, 2) Anterior coxae male and female. (3) Left phallomere in dorsal view. (4) Left phallomere in ventral view. (5) Ventral phallomere. Scale = 1 mm

Ehrmann (2002) mentioned it from Mato Grosso (Urucum) but in our opinion this latter locality must be eliminated, because it is related to a misidentification made by Giglio-Tos (1900), who erroneously assigned to *Oxyops icterica* Sauss. & Zehnt. a male specimen from Urucum (Mato Grosso), as he himself subsequently admitted (1914). Therefore the distribution of this species in South America remains unknown.

Lobocneme colombiae (Hebard, 1919)

Fig. 8

Lobocneme colombiae Hebard, 1919: 137.

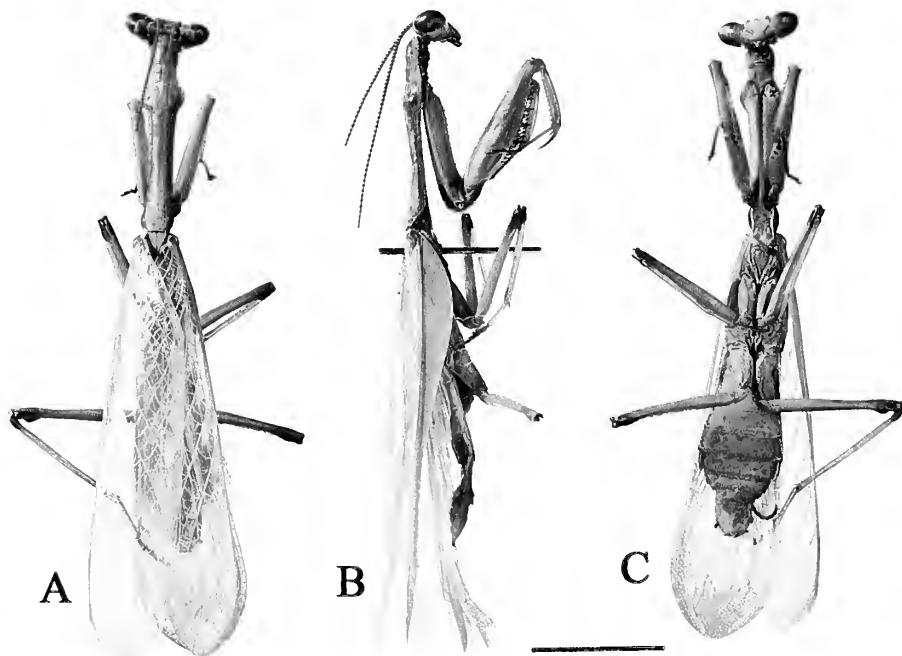
Lobocneme colombiae. – Giglio-Tos, 1927: 601. – Beier, 1964: 950. – Terra, 1995: 68. – Cerdà, 1997: 22. – Ehrmann, 2002: 208. – Otte & Spearman, 2005. – Agudelo *et al.*, 2007: 110.

Material examined: NHMW; 2 females; Colombia, Isla Rosario Caribe, Agosto 1961, (Heidi Stoker leg.).

Note: This species was described by Hebard (1919) based on a single male from Santa Marta (Magdalena Dep.) in Colombia, and the holotype is deposited in the Academy of Natural Sciences in Philadelphia (ANSP). To this species the two female specimens from Isla del Rosario mentioned above must also be assigned. We consider it useful to provide a short description of the female unknown until today.

Description of female: General coloration of body ochraceous (Fig. 7); legs ochraceous; mesothoracic wings with eostal area greenish; discoidal area brown. Methathoracic wings yellow.

Head: pentagonal 2.03 times as wide as pronotal supracoxal dilation; fastigium of the vertex slightly convex and more elevated than the imaginary line joining the apex of eyes; juxtaocular tubercles weakly developed; eyes weakly conical; frontal shield transverse about 2.5 times wider than high. Antennae elongated, all segments with two pairs of short hairs.



Open, swampy l and, near sea, S. end
of Island. Sept. 27. Beaten from bushes.

Parastagmatoptera lobipes.

Holo-type

319

Sp. figured.
Type.

St. Vincent, W.I.
H. H. Smith.

St. Vincent,
W.I.
95-206.

Fig. 6. Holotype of *Parastagmatoptera lobipes*. (A) Dorsal view. (B) Lateral view. (C) Ventral view. Scale 1 cm.

Torax: pronotum slender, about 4.31 times as long as the pronotal supracoxal dilation and 8.9 times as long as its minimum width; lateral margins with small denticles; supracoxal dilation not very developed and with lateral margins widely rounded. Disc of prozone with minute granules; disc of the metazone with an indistinct median carina extending about 1/3 of its length; ratio metazone/prozone is 2.8. Fore legs slender: coxae (Fig. 2) 0.62 times as long as the pronotum, prismatic with a triangular section; inner surface with a black band covering about 1/3 of the length of coxae; all margins with small tubercles with an apical short hair; inner distal lobes divergent. Femora 5.15 times as long as its maximum width, upper margin almost straight, all spines ochre with brown apex. Tibiae reaching half the length of the femora, all spines green with brown apex. Spination formula F=14-16IS/5ES/4DS and T=14-15IS/11ES. Middle and hind legs slender; femora smooth, tibiae and tarsi with scarcely hairs. Posterior metatarsi 1.6 times as long as all other segments together. Wings well-developed, extending well beyond the apex of the abdomen; mesothoracic wing opaque about 2.8 their maximum width, with numerous

windows on the discoidal area; metathoracic wing yellow with numerous concentric hyaline windows.

Abdomen: slender and cylindrical. Supranal plate short, triangular with rounded apex. Cerci extending beyond the subgenital plate, all segments cylindrical wider than long and densely hairy.

Dimensions [mm]: Total length body 32-33; width head 6.45-6.5; length prozona 3.45-3.8; length metazona 9.9-10.4; supracoxal dilation of pronotum 3.15-3.25; minimum width of pronotum 1.5-1.6; length coxae 8.4-8.9; length femur 9.9-10.7; maximum width of femur 1.9-2.1; length tegmina 20-20.2; maximum width tegmina 0.7-0.8.

Distribution: *P. colombiae* occurs in Colombia, in a unspecified locality of Venezuela (Cerdà, 1977), and in the Lesser Antilles (Ehrmann, 2002). It is our opinion that this latter area must be eliminated because a bibliographic research produced no evidence for the presence of this species in these territories.



Fig. 7. Holotypus of *Paroxyopsis icterica* in dorsal view. Scale 1 cm.

Fig. 8. Habitus of the female of *Lobocneme colombiae*. Scale 1 cm.

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Note faunistique sur les oligochètes aquatiques de la région genevoise et de Suisse

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Abstract : Faunistic note on the aquatic oligochaetes of the Geneva area and of Switzerland. Aquatic oligochaetes are used in Switzerland to assess sediment quality of watercourses and lakes. The aim of this note is to mention the presence of new species of aquatic oligochaetes for Switzerland and to update the inventory of this group in the Geneva area (Switzerland). Species diversity was studied in fine/sandy sediments of watercourses (canton of Geneva) and lakes (canton of Bern) as well as in very little studied environments in Switzerland, coarse surficial sediments and the hyporheic zone of watercourses (cantons of Geneva and Valais). Seven new species for Switzerland and twelve new species for the Geneva area were found. The number of taxa in the Geneva area is currently 81. The current development and use of molecular biology (barcoding, high-throughput sequencing technologies) as a tool for aquatic oligochaetes identification will allow researchers to improve significantly future species inventories.

Keywords : Aquatic oligochaetes, inventory, Switzerland, Geneva area, watercourses, lakes.

INTRODUCTION

Les oligochètes sont abondants dans les sédiments fins, sableux et grossiers des cours d'eau et des lacs et sont également présents dans le milieu hyporhéique des cours d'eau et dans les eaux souterraines (Lafont & Vivier, 2006; Vivien *et al.*, 2014). Ce groupe comprend des espèces allant de sensibles à résistantes aux pollutions (type toxique et organique) et il est couramment utilisé comme bioindicateur de la qualité des sédiments fins/sableux des cours d'eau et des lacs (Lafont *et al.*, 2012; Vivien *et al.*, 2014). L'étude des peuplements d'oligochètes dans les sédiments grossiers de surface et le milieu hyporhéique des cours d'eau permet de connaître la qualité de ces milieux et la dynamique des échanges hydrologiques entre les eaux souterraines et les eaux de surface (Lafont & Vivier, 2006).

En Suisse, la présence des oligochètes aquatiques a été signalée depuis la fin du XIX^e siècle dans de nombreux travaux de faunistique (Piguet & Bretscher, 1913) et d'écologie (Frenzel, 1983; Lods-Crozet & Reymond, 2005; Lang, 2009) et un inventaire dans la région genevoise a débuté en 2008 (Vivien & Lafont, 2013; Vivien, 2013). Soixante-neuf taxons ont été rencontrés dans la région genevoise entre 2008 et 2012 au niveau de cours d'eau, d'étangs et des rives du lac Léman.

Dans la région genevoise, la diversité des oligochètes aquatiques a surtout été étudiée au niveau des sédiments fins/sableux de cours d'eau; ailleurs en Suisse, elle

a principalement été étudiée dans les lacs (Vivien & Lafont, 2013). Pour établir un inventaire de ce groupe le plus complet possible, il serait important d'explorer des milieux encore non ou peu étudiés, tels que les sédiments grossiers et le milieu hyporhéique de cours d'eau, les grottes et les eaux souterraines.

Dans le présent travail, nous rapportons les résultats des récoltes d'oligochètes effectuées dans le cadre de divers travaux d'écologie appliquée et de systématique moléculaire. Les prélèvements ont été réalisés dans les sédiments grossiers et le milieu hyporhéique de cours d'eau du canton de Genève (la Seymaz) et du canton du Valais (le Rhône à Finges), ainsi que dans les sédiments fins/sableux de cours d'eau genevois et de lacs du canton de Berne.

MATÉRIEL ET MÉTHODES

Sites d'étude

Les sites d'études se situent dans les cantons de Genève, du Valais et de Berne.

Sédiments fins/sableux de cours d'eau

Cinq stations appartenant à quatre cours d'eau genevois ont été étudiées en 2013 dans le cadre du programme de surveillance de la qualité des cours d'eau du Service de l'écologie de l'eau de l'Etat de Genève (Vivien, 2014a)

(Tab. 1). Des prélèvements ont également été effectués dans la région genevoise en 2012 et 2013 dans le cadre d'un travail de recherche sur le barcoding moléculaire des oligochètes aquatiques effectué au sein du Département de Génétique et Evolution de l'Université de Genève (Vivien *et al.*, 2015). Les récoltes ont été réalisées entre autres dans la Seymaz à Claparède et à De Haller, dans le ruisseau des Eaux-Chaudes et dans le nant d'Avril.

Sédiments de lacs

Onze stations des lacs de Thoune, Bienna et Brienz ont été étudiées en septembre et octobre 2013 dans le cadre d'un suivi de la qualité écologique des sédiments de ces lacs par le Service de protection des eaux et des sols de l'Etat de Berne (Vivien, 2014b; Zweifel, 2014) (Tab. 2).

Sédiments grossiers de surface et milieu hyporhéique

Deux stations de la Seymaz (canton de Genève) et trois stations du Rhône en Valais (à Finges) ont été étudiées en 2013 dans le cadre de mandats d'études pour le Service de l'écologie de l'eau de l'Etat de Genève (Vivien, 2014c) et pour le bureau d'études ETEC (Vivien, 2014d) (Tab. 3).

Prélèvements, tamisage, montage et déterminations

Les sédiments fins/sableux des cours d'eau ont été prélevés à l'aide d'un filet type Surber de vide de maille de 0,2 mm. Les prélèvements ont été effectués à deux ou trois endroits différents (au niveau de la station). Les sédiments fins/sableux de lacs ont été prélevés à l'aide d'une benne type Ekman. Trois prélèvements ont été effectués par station. Le milieu hyporhéique (eau et sédiment) a été prélevé au moyen d'une sonde enfoncée à la masse dans les sédiments grossiers jusqu'à une profondeur de 20-30 cm et d'une pompe Bou-Rouch (Bou & Rouch, 1967) emmanchée sur la sonde. Dix litres ont été pompés par prélèvement. Le volume prélevé a

été filtré sur le terrain au moyen d'un tamis de 0,2 mm de vide de maille. Quatre prélèvements par relevé ont été effectués. Les sédiments grossiers ont été prélevés à l'aide d'une pelle ou d'un filet type Surber de vide de maille de 0,2 mm aux mêmes emplacements que le milieu hyporhéique.

Les vers ont été fixés sur le terrain au formaldéhyde (concentration finale de 5%) pour tous les prélèvements sauf ceux des lacs (fixation après tamisage). Au laboratoire, le tamisage des sédiments a été effectué avec un tamis de 0,5 mm de vide de maille pour les sédiments fins/sableux de cours d'eau, un tamis de 0,315 mm de vide de maille pour les sédiments de lacs et un tamis de 0,2 mm pour les sédiments grossiers et le milieu hyporhéique. Les oligochètes ont été éclaircis dans une solution d'acide lactique/glycérol, puis montés entre lame et lamelle dans une solution d'enrobage permanente composée d'acide lactique, de glycérine et d'alcool polyvinyle (mowiol 4-88).

Tous les spécimens ont été identifiés morphologiquement à l'espèce, au genre ou à la famille (par microscopie optique). Les ouvrages utilisés sont: Sperber (1950); Brinkhurst (1971); Timm & Veldhuijzen van Zanten (2002); Timm (2009).

Dans le cadre du travail de recherche sur le barcoding moléculaire des oligochètes aquatiques (Vivien *et al.*, 2015), un fragment d'environ 658 paires de base du gène COI (cytochrome c oxidase I) de 185 spécimens et la région ITS2 (internal transcribed spacer 2) de 52 spécimens ont été séquencés. Le détail des méthodes utilisées (extraction d'ADN, primers, PCR, traitement et analyse des séquences) est consultable dans Vivien *et al.* (2015). Les séquences des spécimens ne pouvant être identifiés ont été comparées aux séquences disponibles de Genbank (NCBI) à l'aide du programme BLAST (www.ncbi.nlm.nih.gov/BLAST/Blast.cgi). Les séquences de Genbank présentant une forte similarité avec celles de

Tableau 1 : Détails concernant l'échantillonnage (sédiments fins/sableux de cours d'eau).

Cours d'eau	Station	Coordonnées géographiques	Mois des prélèvements	Nombre de spécimens identifiés
Seymaz	De Haller	46.20113°N 6.19611°E	mars, juin, octobre et décembre	458
Seymaz	Claparède	46.18850°N 6.18506°E	mars, juin, octobre et décembre	454
Abbaye de Presinge	aval EIL	46.22419°N 6.24983°E	mars, juin, octobre et décembre	440
Hermance	pont de Crévy	46.28348°N 6.24094°E	juin, octobre et décembre	330
Rouelbeau	amont chemin de Rouelbeau	46.24240°N 6.21896°E	mars	110
Eaux-Chaudes	passerelle aval	46.18603°N 6.00883°E	mars	2
Avril	Bourdigny	46.21661°N 6.04664°E	juin	44

nos spécimens ont été utilisées pour l'assignation d'une espèce aux lignées. Erséus & Gustafsson (2009) et Zhou *et al.* (2010) ont suggéré un seuil de divergence génétique de COI de 10% pour distinguer les espèces d'oligochètes aquatiques. Dans notre travail (Vivien *et al.*, 2015), la délimitation des espèces au moyen de ce seuil de divergence a été appliquée et validée par l'application de la méthode Automatic Barcode Gap Discovery (ABGD) (Puillandre *et al.*, 2012) et les données d'ITS2. Les spécimens barcodés (*Tubifex montanus*, *Bothrioneurum vejdovskyanum*, *Lumbricillus rivalis*, *Helodrilus oculatus* et *Dendrodrilus rubidus*) sont déposés au Muséum d'histoire naturelle de la Ville de Genève. Les numéros de référence de leurs séquençees (European Nucleotide Archive) sont consultables dans Vivien *et al.* (2015).

RÉSULTATS

Douze nouvelles espèces pour la région genevoise ont été rencontrées (Tab. 4). Il s'agit de: *Rhyacodrilus falciformis*, *Amphichaeta leidigi*, *Tubifex montanus*,

Chaetogaster parvus, *Pristina osborni*, *Pristina bilobata*, *Haber speciosus*, *Lumbricillus rivalis*, *Cernosvitoviella atrata*, *Bothrioneurum vejdovskyanum*, *Helodrilus oculatus* et *Dendrodrilus rubidus*. Les spécimens de ces deux dernières espèces ont été déterminés sur la base de leur code-barres génétique (COI) et leur détermination n'a pas été vérifiée faute d'expertise des Lumbricidae. Les divergences génétiques entre nos séquences et celles de Genbank sont de 2,4% pour *H. oculatus* et de 2,9% pour *D. rubidus*.

Parmi les espèces citées ci-dessus, les nouvelles espèces pour la Suisse sont (Tab. 4): *Chaetogaster parvus*, *Tubifex montanus*, *Pristina osborni*, *Haber speciosus*, *Lumbricillus rivalis* et *Bothrioneurum vejdovskyanum*. L'autre nouvelle espèce pour la Suisse est *Quistadrilus multisetosus*, trouvée dans le lac de Biel. Les dernières mentions de *Helodrilus oculatus* et *Dendrodrilus rubidus* en Suisse datent du début du XX^e siècle (Piguet & Bretscher, 1913). *Pristina bilobata* n'avait été mentionné en Suisse que par Piguet & Bretscher (1913) (dans un ruisseau du canton de Zoug) et par Frenzel (1983) (un seul spécimen trouvé dans le lac de Constance).

Chaetogaster parvus et *Lumbricillus rivalis* ont égale-

Tableau 2 : Détails concernant l'échantillonnage (sédiments de lacs).

Lac	Station	Coordonnées géographiques	Nombre de spécimens identifiés
Thoune	profondeur maximale	46.67334°N 7.74909°E	187
	profondeur moyenne	46.68783°N 7.70530°E	7
	zone sublittorale	46.68478°N 7.70228°E	99
	zone proche d'un dépôt de munitions	46.69620°N 7.70338°E	100
	zone éloignée du dépôt de munitions	46.70427°N 7.71323°E	58
Bienne	profondeur maximale	47.10431°N 7.19757°E	100
	profondeur moyenne	47.08386°N 7.15860°E	103
	zone sublittorale	47.08066°N 7.15500°E	100
Brienz	profondeur maximale	46.71784°N 7.95200°E	10
	profondeur moyenne	46.71798°N 7.97083°E	6
	zone sublittorale	46.71464°N 7.97401°E	7

Tableau 3 : Détails concernant l'échantillonnage (sédiments de surface et milieu hyporhéique).

Cours d'eau	Station	Coordonnées géographiques	Mois des prélèvements	Nombre de spécimens identifiés
Seymaz	De Haller	46.20113°N 6.19611°E	mars et septembre	194 (surface), 204 (hyporhéique)
Seymaz	Claparède	46.18850°N 6.18506°E	mars et septembre	125 (surface), 199 (hyporhéique)
Rhône	Rottensand	46.30664°N 7.59028°E	février et avril	112 (surface), 211 (hyporhéique)
Rhône	Amont gravière Salgesch	46.30269°N 7.57249°E	février et avril	50 (surface), 136 (hyporhéique)
Rhône	Aval Finges	46.29543°N 7.55761°E	février et avril	54 (surface), 115 (hyporhéique)

Tableau 4 : Liste des espèces nouvellement recensées dans la région genevoise et/ou en Suisse (en 2013) avec indication du nombre d'individus rencontrés et de leur localisation (station).

¹ espèce nouvelle pour la région genevoise ; ² espèce nouvelle pour la Suisse.

	Nombre d'individus	Localisation (station)
Naididae		
Tubificinae		
<i>Haber speciosus</i> (Hrabě, 1931) ^{1,2}	1	De Haller (milieu hyporhéique)
<i>Quistadrilus multisetosus</i> (Smith, 1900) ²	1	zone sublittorale du lac de Biel
<i>Tubifex montanus</i> Kowalewski, 1919 ^{1,2}	1	De Haller (sédiments sableux)
Naidinae		
<i>Amphichaeta leidigi</i> Tauber, 1879 ¹	2	amont chemin de Rouelbeau
<i>Chaetogaster parvus</i> Pointner, 1914 ^{1,2}	2	Claparède (sédiments grossiers) et aval Finges (sédiments grossiers)
<i>Pristina bilobata</i> (Bretschner 1903) ¹	1	De Haller (sédiments grossiers)
<i>Pristina osborni</i> (Walton, 1906) ^{1,2}	1	De Haller (sédiments grossiers)
Rhyacodrilinae		
<i>Bothrioneurum vejvodskyanum</i> Stolc, 1886 ^{1,2}	3	De Haller (sédiments sableux) et Bourdigny
<i>Rhyacodrilus falciformis</i> Bretschner, 1901 ¹	2	aval EIL
Enchytraeidae		
<i>Cernosvitoviella atrata</i> ¹	4	Claparède (sédiments grossiers)
<i>Lumbricillus rivalis</i> (Levinsen, 1884) ^{1,2}	2	Claparède (sédiments sableux) et Rotensand (milieu hyporhéique)
Lumbricidae		
<i>Dendrodrilus rubidus</i> (Savigny, 1826) ¹	1	passerelle aval
<i>Helodrilus oculatus</i> Hoffmeister, 1845 ¹	1	passerelle aval

ment été rencontrés en 2013 dans le Rhône en Valais (Tab. 4).

Un spécimen de *Trichodrilus* sp. sous forme mature a été rencontré à De Haller (Seymaz) dans le milieu hyporhéique. Il peut appartenir à *T. allobrogum* Claparède, 1862 ou à *T. aporophorus* Popčenko, 1976. Sur les 14 taxons mentionnés, neuf sont indicateurs d'échanges hydrologiques actifs entre les eaux souterraines et les eaux de surface (Lafont & Vivier, 2006). Il s'agit de : *Chaetogaster parvus*, *Pristina osborni*, *Pristina bilobata*, *Haber speciosus*, *Cernosvitoviella atrata*, *Trichodrilus* sp., *Bothrioneurum vejvodskyanum*, *Rhyacodrilus falciformis* et *Quistadrilus multisetosus*. Les six premiers taxons ont été trouvés dans des sédiments grossiers et/ou en zone hyporhéique.

DISCUSSION

Trichodrilus allobrogum et *Trichodrilus aporophorus* sont des espèces très proches et difficiles à distinguer. *T. aporophorus* possède des crochets antérieurs plus courts que les crochets des parties médiane et postérieure (Timm, 2009). Ce caractère semble ne pas avoir été reporté chez *T. allobrogum*. Les crochets antérieurs de notre spécimen

sont nettement plus courts que ceux des parties médiane et postérieure. Cependant, *T. aporophorus* est une espèce très rare, signalée jusqu'à présent uniquement en Carélie (nord-ouest de la Russie) (Timm, 2009). *T. allobrogum* a par contre été mentionné en Suisse par Piguet & Bretschner (1913), et précisément dans la Seymaz, le cours d'eau dans lequel notre spécimen a été trouvé.

Pristina bilobata se distingue de *Pristina foreli* en particulier par l'absence de trompe (Timm, 2009). Notre spécimen de *P. bilobata* n'a été séparé de *P. foreli* que sur la base de ce caractère. Les autres caractères qui séparent ces deux espèces sont difficilement observables par microscopie optique.

Chaetogaster parvus est parfois considéré comme synonyme de *Chaetogaster langi* Bretschner, 1896 (Sperber, 1950; Timm, 2009). Pourtant *C. parvus* se distingue de *C. langi*, en particulier par la forme de la dent distale des crochets : chez *C. parvus*, la dent distale est nettement plus fine et plus courte que la dent proximale, alors que chez *C. langi*, les dents distale et proximale sont de la même épaisseur et de la même longueur (Lafont, 1981). Sur nos échantillons, nous distinguons clairement les deux espèces sur la base de ce caractère.

Hormis *Tubifex montanus*, *Chaetogaster parvus* et *Pristina bilobata*, les espèces rencontrées sont plutôt

communes dans les systèmes d'eau douce européens. *T. montanus*, *C. parvus* et *P. bilobata* ont été rarement mentionnés en Europe.

Il est possible que *Quistadrilus multisetsosus* (trouvé dans le lac de Biel) soit récemment apparu en Suisse. Il serait intéressant de suivre l'évolution de sa population dans le futur. Timm (2009) mentionne que cette espèce a apparemment été introduite en Europe. L'apparition en Suisse au XX^e siècle de plusieurs espèces d'oligochètes, telles que *Branchiura sowerbyi* Beddard, 1892 et *Potamothenrix moldaviensis* Vejdovsky & Mrazek, 1903 a été suggérée (Vivien & Lafont, 2013). Il n'est en revanche pas possible d'affirmer que les autres taxons nouvellement recensés (trouvés dans des cours d'eau) peuvent avoir été récemment introduits en Suisse, car la diversité des oligochètes a peu été étudiée dans les cours d'eau en Suisse avant 2008.

Les taxons indicateurs d'échanges hydrologiques entre la nappe et le cours d'eau se rencontrent en particulier dans les sédiments grossiers et le milieu hyporhéique. Dans le présent travail, trois nouvelles espèces pour la Suisse ont été trouvées grâce à l'étude de ces milieux. Le nombre de taxons dans la région genevoise est actuellement de 81. Ce nombre important malgré la faible superficie de la région peut être expliqué par la diversité assez importante des milieux/habitats explorés, par le grand nombre de spécimens déterminés (environ 11 650 depuis 2008) et par le fait que les prélèvements ont été effectués dans des sédiments présentant des degrés de pollution très divers et à différentes périodes de l'année.

L'établissement d'inventaires complets des oligochètes aquatiques sur la base d'études morphologiques est une tâche difficilement réalisable : la plupart des espèces au sein des Tubificinae, Lumbriculidae et Enchytraeidae ne peuvent être identifiées qu'à l'état mature et la détermination de la grande majorité des Lumbriculidae et Enchytraeidae est difficile et requiert la pratique de la dissection. De plus, de nombreuses études ont révélé la présence d'espèces cryptiques au sein des oligochètes aquatiques (Sturmbauer *et al.*, 1999 ; Beauchamps *et al.*, 2001 ; Envall *et al.*, 2012 ; Martinsson *et al.*, 2013). Le développement et l'utilisation de méthodes moléculaires, actuellement en cours, permettront de déterminer tous les spécimens à l'état immature et les spécimens de familles et groupes difficiles et d'améliorer nos connaissances sur les espèces cryptiques (Vivien *et al.*, 2015). Le recours au barcoding et au séquençage à haut débit (Next-generation sequencing) (Carew *et al.*, 2013) permettra d'améliorer significativement les inventaires d'oligochètes aquatiques.

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Notes on some hydroids (Cnidaria) from Martinique, with descriptions of five new species

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Abstract: The present report supplements a series of earlier accounts on the hydrozoan fauna of the French Lesser Antilles, and discusses 16 species of hydroids from Martinique. Of these, five are new to science: *Hydractinia promiscua*, *Halecum plicatum*, *Dynamena bimorpha*, *Antennella quaterna* and *Monostaechas bertoti*. The medusoid gonophores of *Ralpharia gorgoniae* Petersen, 1990 are described in detail. The female gonothecae of *Halecum labiatum* Billard, 1933, recorded for the second time, are redescribed. Characters of the trophosome and the cnidome composition allowed a reliable identification of *Halecum lightbourni* Calder, 1991, a species whose previously unknown gonothecae are here described for the first time. A reexamination of the type of *Dynamena tropica* Stechow, 1926 proved that it is conspecific with *D. crisioides* Lamouroux, 1824. *Sertularia notabilis* Fraser, 1947 is included in the synonymy of *S. hattori* Leloup, 1940, and arguments for doing so are provided. The so called variety *pusilla* Ritchie, 1910, associated for a long time with *Hincksella cylindrica* (Bale, 1888), is raised to species, as *H. pusilla* (Ritchie, 1910), and their distinguishing characters are emphasized. *Clytia edentula* Gibbons & Ryland, 1991 is found for the second time, extending its known range of distribution.

Keywords: Hydrozoa - Lesser Antilles - French West Indies - Caribbean.

INTRODUCTION

The hydrozoan fauna of the French Lesser Antilles, never investigated in the past, has received increasing attention during the last few years, with a number of taxonomical studies that provided the first comprehensive accounts on the species composition of two overseas departments, Guadeloupe and Martinique (Galea, 2008; 2010a; 2013; Galea *et al.*, 2012; Galea & Ferry, 2013).

Additional samples from Martinique were gathered during a recent survey undertaken in January and February 2014. New stations have been explored, and some of those inspected in 2012 (see Galea, 2013) were visited again.

The present study deals with those species that have not been the subject of earlier accounts, as well as with those for which new data became available, such as the finding of fertile specimens, allowing reliable taxonomic determination to be made for materials identified previously to genus only.

MATERIAL AND METHODS

Sampling was done either by scuba diving or snorkeling. Hydroid colonies were carefully removed from their substrate using haemostatic forceps, so as to preserve the integrity of the adjacent fauna. Although some observations were done on living specimens shortly after collection, most of them were carried out on formalin-preserved material, using the methods described in Galea (2007, 2008, 2010a). Samples were deposited in collections of the Muséum d'Histoire Naturelle of Geneva, Switzerland, and registration codes are indicated by MHNG-INVE- followed by numbers. Occasionally, references are made to samples either hosted in the private collection of the senior author of this study (these are indicated by HRG- followed by a four-digit number) or belonging to the British Antarctic Survey (BAS).

TAXONOMY AND RESULTS

Order Anthoathecata Cornelius, 1992
Family Hydractiniidae L. Agassiz, 1862
Genus *Hydractinia* Van Beneden, 1844

***Hydractinia promiscua* Galea & Ferry, sp. nov.**
 Figs 1A, B; 3A-E; Table 1

Holotype material: MHNG-INVE-91108; sample #M280; France, Martinique, Le Prêcheur, Babody, 14.78632° -61.21765°, 20 m; 25.01.2014; male colony encrusting the outside of a worm tube and adjacent sponge.

Paratype material: MHNG-INVE-91124; sample #M335; France, Martinique, Le Prêcheur, Babody, 14.78632° -61.21765°, 15-20 m; 25.06.2014; male colony on ascidian.

Diagnosis: Hydractiniid growing on various substrates, with gastro-, gono-, and tentaculozoooids. Gonophore a non-liberated medusoid with four radial canals and eight tentacle stumps. Nematocysts comprising desmonemes, two size classes of microbasic euryteles, and three size classes of haplonemes.

Etymology: From the Latin *prōmīscūa*, meaning indiscriminately, for its unselective substrate affinity.

Description: Colony stolonial, with creeping, scarcely branching and anastomosing hydrorhiza. Perisarc thin, smooth to irregularly wrinkled, ending at base of polyps; spines absent; no naked coenosarc. Polyps of three types: gastro-, gono-, and tentaculozoooids. Gastrozooids creamy-white in color, clavate, contractile; 12-20 filiform tentacles, amphicoronate in life; hypostome dome shaped, with a wide belt of nematocysts between mouth and insertion of tentacles (Fig. 3A). Gonozooids smaller than their feeding counterparts, with 8-11 filiform tentacles, and a belt of nematocysts around hypostome (Fig. 3B). Gonophores 1-2 per gonozooid, given off laterally from proximal halves of polyps; only males present. Ripe gonophores nearly spherical, width slightly exceeding height (Fig. 3B²); four radial canals and a barely visible circular canal (Fig. 3B¹); manubrium surrounded by apparently four compact, interradial masses of sperm cells; no signs of rudimentary tentae knobs at this stage (Fig. 3B¹). More advanced medusoids (Fig. 3C), whose gametes had been expelled, are still attached to their corresponding gonozooids; their shape had changed from spherical to oval, their length being greater than the diameter; 8 rudimentary tentacles (four perradial and four interradial), as well as a velum, are present. Tentaculozoooids filiform (Fig. 3D), sparsely and irregularly scattered amongst the other zooids; of varied length, sometimes exceeding the size of gastrozooids. Cnidome: 1) desmonemes (Fig. 3E¹); 2, 3) small and large microbasic euryteles (Fig. 3E²⁻³); 4-6) egg-shaped,

elongate and slender, as well as ovoid haplonemes (Fig. 3E⁴⁻⁶).

Dimensions: Gastrozooids up to 3 mm high; gonozooids up to 1 mm high (preserved material, though not differing much from live material). Unspent gonophore ca. 890 µm long and 745 µm wide; spent gonophore ca. 915 µm long and 760 µm wide. Desmonemes (6.3-6.8)×(3.4-3.7) µm; small microbasic euryteles (7.4-7.7)×(2.6-2.8) µm; large microbasic euryteles (9.7-10.6)×(3.1-3.4) µm; egg-shaped haplonemes ca. 5.1×3.1 µm; elongate and slender haplonemes (9.4-10.3)×(2.3-2.6) µm; ovoid haplonemes (10.0-10.3)×(4.0-4.3) µm.

Distribution: Known only from Martinique (present study).

Type locality: France, Martinique, Le Prêcheur, Babody.

Remarks: Notoriously difficult to identify, the hydractiniid hydroids – especially those producing medusoids – offer few exploitable distinguishing morphological features. In addition, several structures, such as the spines and/or the dactylozooids, occur in certain conditions and, as a consequence, they do not offer enough features to the species that produce them in order to establish reliable comparisons with other congeners.

To compare the present hydroid with its relatives, only the non-calcareous species producing medusoid gonophores with radial canals were considered (see Table 1). Since the genera *Schuchertinia* and *Bouillonactinia* (both introduced by Miglietta *et al.*, 2010) are not well characterized, all nominal species discussed herein are referred to the widely speciose genus *Hydractinia* Van Beneden, 1844.

A considerable impediment concerns the species for which only limited descriptions are available and/or no data on the cnidome composition exist (*e.g.* Clarke, 1882; Sigerfoos, 1899; Broch, 1914; Wedler & Larson, 1986; Hirohito, 1988).

For example, the relationships between *H. arge* (Clarke, 1882) and *H. hooperii* (Sigerfoos, 1899) are unsettled yet. According to Calder (1988), their types are reportedly lost, thus preventing a comparison of their cnidomes. Calder (1971) provided arguments in favor of their specific separation, whereas he united them in a later study (Calder, 1988). The Bermudian specimens assigned to *H. arge* in his latter account may not belong to Clarke's taxon, owing to: 1) their smaller size; 2) their exclusive occurrence on gastropod shells instead of being mainly epiphytic [an occurrence of *H. arge* on the gastropod *Bittium* sp. was noted by Calder (1971)]; 3) the lack of gastrozooid autotomy, as described by both Clarke (1882) and Calder (1971) [note that Bavestrello *et al.* (2000) showed that water movement induced transverse fission in the zooids of *H. pruvoti* (Motz-Kossowska,

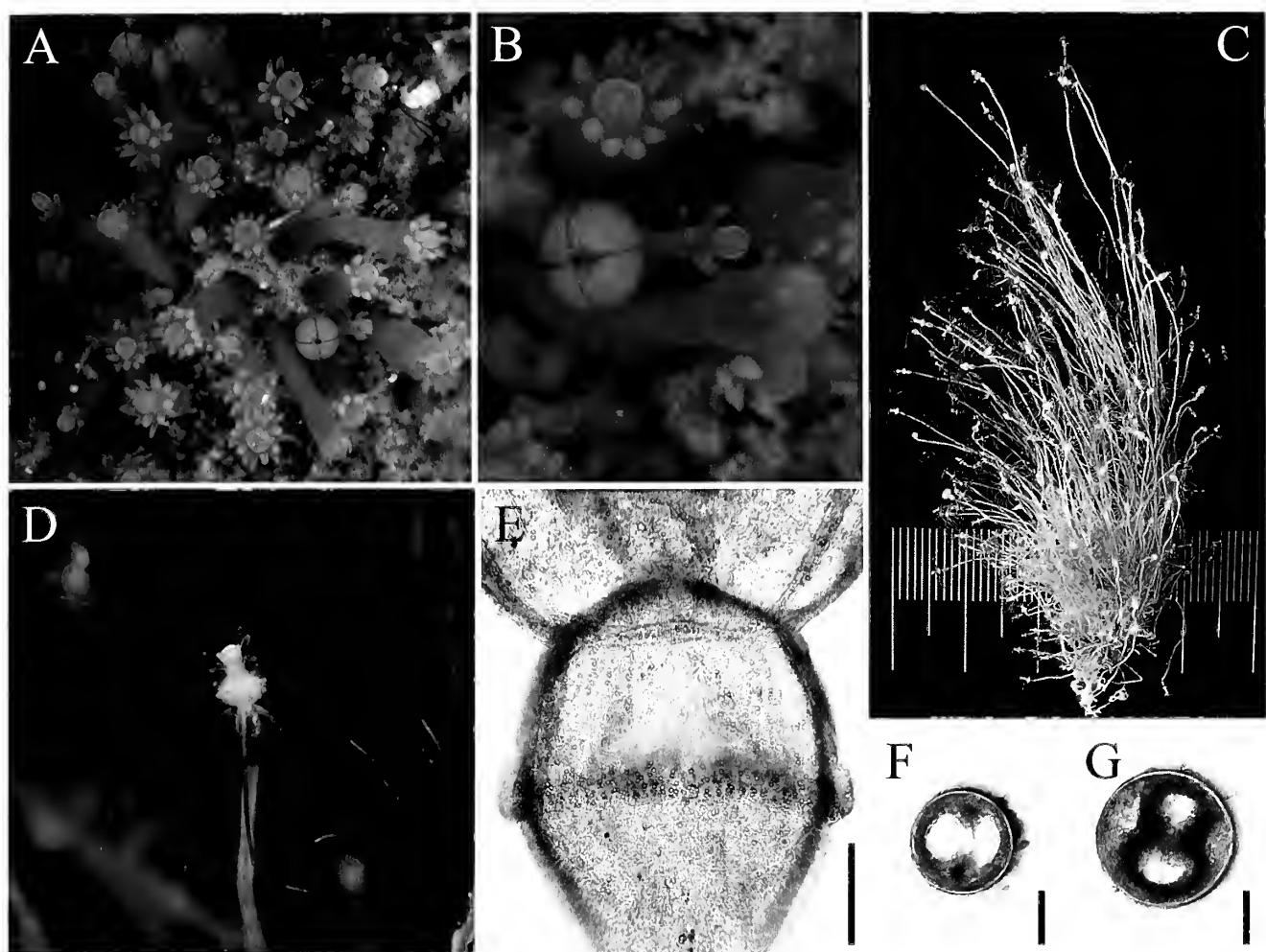


Fig. 1. A, B: *Hydractinia promiscua* sp. nov. (A) Portion of colony growing on worm tube. (B) Detail of a gonozooid carrying a male medusoid. (C-G): *Ectopleura* sp. (C) Whole colony. (D) Hydranth. (E) Detail of the neck region showing belt of nematocysts. (F, G) Cross sections through two stems, showing endodermal ridges. Scale bars: 100 µm (F, G), 200 µm (E).

1905), suggesting that the autotomy observed in *H. arge* may not be an intrinsic feature of this species, depending instead on environmental factors].

It is obvious that, for reliable comparisons, the cnidome composition should be emphasized, though it is obvious that this approach has its limits too, due to some variation in size of the capsules from one sample to another, and their assignment to a given type. The following examples are edifying: 1) Namikawa (2000) found differences in the size of nematocysts of *H. misakiensis* from two localities; 2) similar data also emerge from the accounts of Millard (1975) and Vervoort (2006) on *H. multotentaculata*, unless they dealt with different species; 3) one of the size classes of microbasic euryteles reported by Namikawa (1991) in his *H. multigranosi* is said to belong to the haplonemes in a later study (Namikawa, 2000).

In addition, the small size and/or the rare occurrence of some nematocysts could easily lead the examiner to overlook them. It is also likely that capsules of the same type, but belonging to different size classes, were lumped together, as illustrated by the accounts of Millard (1955,

1975) on *Hydractinia altispina* and *H. multotentaculata*, respectively. We agree with Schuchert (P. Schuchert, pers. comm.) that some of these rare capsules, as well as the so called size classes observed in certain categories of nematocysts, might be no more than early and intermediate stages, respectively, in the formation of fully-functional capsules. In order to use them reliably as taxonomic discriminators, their occurrence should be documented carefully in multiple hydroid populations of a given species.

Owing to the taxonomical impediments discussed above, it is likely that molecular techniques may prove to be the only truly reliable method of separating these difficult hydroid species.

Although the available data on all species of medusoid-producing hydractiniids are summarized in Table 1, the present hydroid is compared in more detail to its congeners from the temperate to tropical western North Atlantic. Indeed, due to their mostly epizoic habit, these hydroids are not expected to occur outside their known geographical areas.

Table 1. Comparison between *Hydractinia promiscua* sp. nov. and its medusoid-producing allies. The abbreviations used are as follows: AI (atrichous isorhizas), BI (basitrichous isorhizas), DE (desmonemes), HA (haplonemes), HE (heteronemes), mBE (microbasic eurytelles), mBM (microbasic mastigophores), UC (unidentified capsules); N.A. signifies that no information is available.

Species name	Reference(s)	Distribution	Cnidome (μm)	Substrate	Hydrorhiza	Spines	Types of dactylozooids
<i>H. aculeata</i> (Wagner, 1833)	Schuchert (2008, 2014)	Mediterranean	DE: (5-7.5) \times (3.5-4); HE: (14-17) \times (3.5-4); mBE: (6.5-8) \times (2.5-3)	Gastropod shells inhabited by molluscs or hermit crabs	From reticulate to encrusting	Smooth	Tentaculozooids
<i>H. allmanni</i> Bonnevie, 1898	Schuchert (2008)	Arctic to northern boreal	DE: (6-7) \times (3-4); UC: (14-16) \times (4-5); HE: (9-11) \times (3-4)	Gastropod shells	Crustlike with naked coenosarc	Short, conical with rounded tips	Absent
<i>H. altispina</i> Millard, 1955	Millard (1955, 1975)	South Africa	DE: 6 \times 3.6; mBE: (8.4-13.8) \times (2.4-5.4) in apparently 2 size classes	Gastropod shell	Hydrorhiza covered with layer of free coenosarc	Long, smooth	Absent
<i>H. arctica</i> (Jäderholm, 1902)	Schuchert (2008)	Greenland	DE: 6 \times 4; mBE: (8.5-9.5) \times (2.5-3.0); mBM: (12-14) \times (4-5)	Gastropod shells	Hydrorhiza loosely meshed, covered with perisarc	Absent	Absent
<i>H. arge</i> (Clarke, 1882)	Clarke (1882), Calder (1971)	Atlantic coast of N America	N.A.	Mostly epiphytic, also on gastropod shells	"Hydrorhizal mat" covered by coenosarc	Absent	Absent
<i>H. arge</i> (Clarke, 1882) sensu Calder (1988)	Calder (1988)	Bermuda	DE: (5.0-5.7) \times (2.8-3.3); HA: (4.9-6.6) \times (2.4-2.7); mBE: (7.3-7.8) \times (2.6-2.8) and [8.3-10.2] \times (2.9-3.7)	Gastropod shells	Branching, anastomosed stolons	Inconspicuous	Absent
<i>H. arge</i> (Clarke, 1882) sensu Wedler & Larson (1986)	Wedler & Larson (1986)	Puerto Rico	N.A.	Gastropod shell with hermit crab	"Very dense net"	Absent	Absent
<i>H. berkenkensis</i> (Watson, 1978)	Watson (1978), Bouillon <i>et al.</i> (1997)	Australia	(?) BI: 6.5 \times 2.5; (?) mBE: 4.5 \times 2.5	Gastropod shells	Reticulate	Absent	Absent
<i>H. calderi</i> Bouillon <i>et al.</i> , 1997	Bouillon <i>et al.</i> (1997)	Alboran Sea	DE: (6.3-7.5) \times (3.2-3.6); mBE: (8.7-11.0) \times 3.2	Gastropod shells	Hydrorhiza reticulate	Present	Present, type not stated
<i>H. canalicifera</i> Millard, 1957	Millard (1957, 1975)	South Africa	N.A.	Seaweed	Hydrorhiza encrusted in centre of colony, covered with naked coenosarc	Absent	Tentaculozooids
<i>H. cytaeiformis</i> Verwoort, 2006	Verwoort (2006)	Cape Verde	DE: [(3.2-3.6) \times (2.7-3.2)] and (ca. 4.9 \times 4.5); mBE: (6.3-8.0) \times (3.2-3.6);	Worm tube	Stolons densely packed, intertwined, anastomosing, no naked coenosarc	Absent	Tentaculozooids
<i>H. dentiflami</i> (Thornely, 1904)	Thornely (1904)	Palk Strait	N.A.	Gastropod shell with hermit crab	"Basal crust"	Present	Absent
<i>H. denkhani</i> (Thornely, 1904) sensu Stechow (1912)	Stechow (1912)	Bab-el-Mandeb Strait	N.A.	Gastropod shell with hermit crab	N.A.	N.A.	Absent
<i>H. diogenes</i> Millard, 1959	Millard (1959, 1975)	Mozambique	DE: 5 \times 3.5; mBE: 9 \times 4	Gastropod shells with hermit crabs	Dense mat covered by layer of free coenosarc	Short, smooth	Spiral zooids

Species name	Reference(s)	Distribution	Cnidome (μm)	Substrate	Hydorhiza	Spines	Types of dactylozooids
				Structure, condition of coenosarc			
<i>H. epicnioncha</i> Stechow, 1907	Siechow (1909), Hirohito (1988)	Japan	N.A.	Gastropod shells	Crust-like, covered by naked coenosarc	Two types	Tentaculozooids
<i>H. granulata</i> Hirohito, 1988	Hirohito (1988)	Japan	N.A.	Gastropod shell inhabited by hermit crab	Dense mat covered by naked coenosarc	Smooth or rugose	Spiralozooids + tentaculozooids
<i>H. hooperi</i> (Sigerfoos, 1899)	Sigerfoos (1899)	Vicinity of New York	N.A.	Gastropod shells	Highly ramified and anastomosed, no naked coenosarc	Small	Absent
<i>H. hooperii</i> (Sigerfoos, 1899) sensu Wedler & Larson (1986)	Wedler & Larson (1986)	Puerto Rico	N.A.	Gastropod shell	Reticular	Absent	Absent
<i>H. inermis</i> (Allman, 1872)	Schuchert (2008, 2014)	Mediterranean	DE: (4.5-5) \times 2.5; mBE: [(7.5-8) \times 2.5] and (9 \times 3)	Algae, barnacles, sponge, rocks	Tightly reticulate but never encrusting, covered by perisarc	Absent	Absent
<i>H. kaffaria</i> Millard, 1955	Millard (1955)	South Africa	N.A.	Gastropod shells	Covered with layer of free coenosarc	Absent	Tentaculozooids
<i>H. marsupialis</i> Millard, 1975	Millard (1975)	South Africa	UC: (7.2-10.2) \times (2.7-3.6); UC: 5.4 \times 3.0	Gastropod shells	From perisarc-covered tubes to coalescent and covered with naked coenosarc	Smooth and short	Absent
<i>H. michaelseni</i> Broch, 1914	Broch (1914)	Senegal	N.A.	Gastropod shell with hermit	Naked coenosarc present locally	Present	Spiralozooids
<i>H. misakiensis</i> (Iwasa, 1934)	Iwasa (1934), Hirohito (1988), Namikawa (2000)	Japan	DE: (5.6-7.2) \times (2.8-3.6); mBE: [(7.6-9.2) \times (2.8-3.2)] and [(10.4-14.0) \times (3.2-4.8)]; Al: (4.0-5.6) \times (1.6-2.0)	Gastropod shells inhabited by molluscs or hermit crabs	Closely reticulated, covered by perisarc	Smooth	Tentaculozooids
<i>H. multigranosi</i> (Namikawa, 1991)	Namikawa (1991, 1995)	Japan	DE: (5.7-7.2) \times (2.7-3.9); mBE (?) or HA: [(4.8-5.6) \times (1.6-2.4)]; mBE: [(8.8-9.6) \times (2.8-3.2)] and [(10.4-11.2) \times (3.6-4.0)]	Gastropod shells	Stolonial growth, covered by perisarc	Absent	Tentaculozooids
<i>H. multotentaculata</i> (Millard, 1975)	Millard (1975), Vervort (2006)	South Africa, Mauritania	DE: (5.4-7.2) \times (3.0-3.6); mBE: [(9.0-13.8) \times (2.4-4.2)], possibly in two size classes	Gastropod shells	Network of coalesced perisarcal tubes covered by layer of free coenosarc	Smooth or slightly corrugated	Spiralozooids
<i>H. panicipinata</i> Vervort, 2006	Vervort (2006)	Cape Verde	DE: (3.6-4.1) \times (2.3-2.7); mBE: [(5.0-5.4) \times (2.7-3.2)] and [(7.0-7.5) \times (1.8-2.3)]	Gastropod shells	Stolonial tubes fused forming thin, solid plate, covered by coenosarc	Two sizes	N.A.
<i>H. piscicola</i> (Komai, 1932)	Komai (1932), Yamada (1959), Kubota (1991)	Japan	DE: (5.6-6.6) \times (3.2-3.6); mBE: [(8.6-11.2) \times (2.8-4.0)] and [(11.2-16.0) \times (3.8-4.8)]	Scorpaenid fishes	Loosely reticulated	Occasionally present	Absent
<i>H. proboscidea</i> (Hincks, 1868)	Schuchert (2008)	British Is. to Alboran Sea	DE: (8-9) \times 4; mBE: 12 \times (3-4)	Inert substrates (rocks, laminarians)	Network of perisarc covered stolons	Smooth	Tentaculozooids

Species name	Reference(s)	Distribution	Cnidome (μm)	Substrate	Structure, condition of coenosarc	Hydrorhiza	Spines	Types of dactylozooids
<i>H. promiscua</i> sp. nov.	Present study	Caribbean	DE: (6.3-6.8) \times (3.4-3.7); mBE: [(7.4-7.7) \times (2.6-2.8)] and [(9.7-10.6) \times (3.1-3.4)]; HA: (ca. 5.1-3.1), [(9.4-10.3) \times (2.3-2.6)], and [(10.0-10.3) \times (4.0-4.3)]	Worm tube, ascidian	Loosely reticular hydrorhiza	Absent	Tentaculozooids	
<i>H. pruvoti</i> Motz-Kossowska, 1905	Schuchert (2008)	Mediterranean	DE; two size classes of (?) HE	Gastropod shells	Reticulate stolons or coalescent into crust "Netlike"	Occasionally present, smooth	Tentaculozooids	
<i>H. sandrae</i> (Wedder & Larson, 1986)	Wedder & Larson (1986)	Puerto Rico	N.A.	Ascidian	"Netlike"	Absent	Likely absent	
<i>H. simplicifloris</i> (Hirohito, 1988)	Hirohito (1988)	Japan	N.A.	Gastropod shell	Closely reticulated, covered by perisarc	Smooth, nipp-like to conical	Tentaculozooids (characteristically short, papillary)	
<i>H.</i> sp.	Galea (2013)	Martinique	DE: (6.9-7.2) \times (3.7-4.0); mBE: [(8.0-8.5) \times (2.9-3.2); HE: [(9.8-10.4) \times (4.2-4.5)] and [(13.3-14.4) \times (3.7-4.0)]; UC: [(6.4-6.6) \times (3.2-3.4)]	Limestone and sponge	Creeping, ramified hydrorhiza, no naked coenosarc	Absent	Tentaculozooids	
<i>H.</i> sp. (as <i>Syactis</i> sp.)	Wedder & Larson (1986)	Puerto Rico	N.A.	Gastropod shell	"Wide-meshed hydrorhizal net"	Absent	Absent	

Species name	Gastrozooids	Gonozooids	Gonophore					
	Size (mm)	Tentacle number	Tentacle rows	Nematocysts around hypostome	Size (mm)	Radial canals	Marginal rudimentary tentacles	Oocyte number
<i>H. aculeata</i> (Wagner, 1833)	1.5-2	12-18	2	Present	< 0.6	3-10	Present	Upper third N.A. (♂); (♀)
<i>H. allmanni</i> Bonnevie, 1898	5-15	10-16	1	Present	< 5	0-6	Present	Upper third 2 1000-1200 4 8 (per radial longer than interradial)
<i>H. altispina</i> Millard, 1955	4	5-12	1	N.A.	0.44	3-5	N.A. Near base N.A. ca. 800 460-360	420-510 4 Absent ca. 32 30-36, or more < 100
<i>H. arctica</i> (Jäderholm, 1902)	2	18-22	2-3	Present	0.5	"few stumps"	N.A. Just below tentacle whorl 2 N.A.	Possibly present Absent ca. 10
<i>H. arge</i> (Clarke, 1882)	< 40	14-20	2	N.A.	< 10	4-13	N.A. At 3/4 apically 4-10	4 8 > 10
<i>H. arge</i> (Clarke, 1882) sensu Calder (1988)	2	8-16	2	N.A.	1.7	5-10	N.A. Proximal to tentacular whorl 2 ca. 800 1100-1200	4 8 > 12

Species name	Gastrozooids				Gonozooids				Gonophore				
	Size (mm)	Tentacle number	Tentacle rows	Nematocysts around hypostome	Size (mm)	Tentacles number	Nematocysts around hypostome	Position of gonophores on zooid	Gonophore nb.	Size (μm)	Radial canals	Marginal rudimentary tentacles	Oocyte number
<i>H. argo</i> (Clarke, 1882) sensu Wedler & Larson (1986)	10-20	15-30	2	N.A.	15-20	5-15	N.A.	Upper half	2-3	N.A.	Presumably 4	N.A.	Likely about 20 or more
<i>H. beikensis</i> (Watson, 1978)	1.2	8-15	1	N.A.	0.65-0.8	ca. 8	N.A.	Below the tentacles	< 5	ca. 400	4	0	12
<i>H. calderi</i> Bouillon et al., 1997	5	20-40	3	N.A.	0.5-2.5	2-14	N.A.	Upper half	1-3	ca. 800	4	8 (4 small, 4 more developed)	"numerous"
<i>H. canalicula</i> Millard, 1957	2-3.2	10-14	1	N.A.	1.3	6-9	N.A.	Upper half	4-5	< 500	4	Absent	> 50
<i>H. cytaeiformis</i> Vervoort, 2006	0.5-0.9	10-12	1	N.A.	0.22-0.23	0	N.A.	Middle part	1-2	115-160	4	4	ca. 8
<i>H. denhami</i> (Thornely, 1904)	N.A.	ca. 24	N.A.	N.A.	N.A.	4-5	N.A.	Middle part	2	N.A.	4	N.A.	N.A.
<i>H. denhami</i> (Thornely, 1904) sensu Stechow (1912)	N.A.	N.A.	N.A.	N.A.	8-10	N.A.	Upper third	4-6	N.A.	4	8	12-20	
<i>H. diogenes</i> Millard, 1959	2-3	10-26	N.A.	N.A.	N.A.	5-15	N.A.	Near distal end	< 6	450×460 (♂); 390×430 (♀)	Presumably 4	Absent	5-13
<i>H. epicnioncha</i> Stechow, 1907	< 6 (rarely 50)	8-30	2	N.A.	1.5-3	8-10 (or more)	N.A.	Above middle part	2-5	ca. 800×600	4	8	ca. 30
<i>H. granulata</i> Hiroito, 1988	2	< 16	1	N.A.	N.A.	4-10	N.A.	Above middle part	4-5	N.A.	4	8	> 20
<i>H. hooperii</i> (Sigerfoss, 1899)	20-25	15-35	1	N.A.	N.A.	6-15	N.A.	Just below tentacle whorl	1-7	Length ca. 1000	4	8	Manubrium "engorged with sexual cells"
<i>H. hooperi</i> (Sigerfoss, 1899) sensu Wedler & Larson (1986)	15	15-20	1	N.A.	N.A.	4-9	N.A.	Upper half	ca. 3	N.A.	Presumably 4	N.A.	N.A.
<i>H. inermis</i> (Allman, 1872)	2-3	12-22	2	Present	0.5-1	6-16	Present	Middle of body	4-8	N.A.	4	8	10-20
<i>H. kaffaria</i> Millard, 1955	2	8-15	2	N.A.	1.1	5-12	N.A.	Upper third	N.A.	550×500 (♂); 450×400 (♀)	4	"indication" of tentacles	21-32

Species name	Gastrozooids				Gonozooids				Gonopore				
	Size (mm)	Tentacle number	Tentacle rows	Nematocysts around hypostome	Size (mm)	Tentacle number	Nematocysts around hypostome	Position of gonophores on zooid	Gono-phore nb.	Size (mm)	Radial canals	Marginal rudimentary tentacles	Oocyte number
<i>H. marsupialis</i> Millard, 1975	1.9	8-16	1	N.A.	0.8	5-9	N.A.	Upper half	< 6	700×600	4	4-8	20-40
<i>H. michaelsoni</i> Broch, 1914	4	20-25	2	N.A.	ca. 1	4-6	N.A.	Just below the tentacles	2-4	N.A.	4	4	Unknown
<i>H. misakiensis</i> (Iwasa, 1934)	1-4	< 30	Likely > 1	Present	N.A.	< 20	N.A.	Above middle part	1-5	ca. 500	4	8	> 20
<i>H. multigranosi</i> (Namikawa, 1991)	0.5-2.15	8-16	1	N.A.	0.5-2	4-11	N.A.	Above middle part	1-8	250-350	3-4	Absent	1-6
<i>H. multiftentaculata</i> (Millard, 1975)	< 8.0	40-91	Several	N.A.	< 3.2	7-13 (♂)	N.A.	Upper third	3-4 (♂)	660×680 (♂); 700×680 (♀)	4	4 (♀)	ca. 300
<i>H. panicispinata</i> Vervoort, 2006	1.2-1.6	14-16	2	N.A.	N.A.	< 10	N.A.	Upper third	2-3	ca. 500 (♀)	4	Absent	"fairly large" ca. 30
<i>H. piscicola</i> (Komai, 1932)	10	11-30	1	Present	1.4-3.3	< 12	Present	Upper third	1-3	ca. 400	4	4	
<i>H. proboscidea</i> (Hincks, 1888)	1-5	10-32	2-3	Present	0.7	6-12	Present	Upper third	2-10	N.A.	4	4-8 (♂); 8-10 (♂)	16-70
<i>H. prominens</i> sp. nov.	3	12-20	1	Present	1	8-11	Present	Proximal half	1-2 (♂)	ca. 890×745 (♂)	4	8	Unknown
<i>H. pruvoti</i> Motz-Kossowska, 1905	1-6	8-14	1	Absent	N.A.	1-3	Absent	Upper third	3-8 (♂)	1000×(600-700) (♂)	4	4	> 100
<i>H. sandrae</i> (Wedler & Larson, 1986)	2	11-16	1	N.A.	0.5-1.5	4-11	N.A.	Shortly below tentacle whorl	2-3 (♂)	N.A.	Presumably 4	N.A.	N.A.
<i>H. simipapillaris</i> (Hirohito, 1988)	1.5	6-12	1	N.A.	< 0.75	0	N.A.	Upper third	2-3 (♂)	ca. 2000 (♂)	4	4	Tens ?
<i>H.</i> sp.	N.A.	12-16	1	Present	N.A.	6-12	Present	Above middle part	1 (♂)	ca. 335×395 (♂)	4	Absent	Unknown
<i>H.</i> sp. (as <i>Syactis</i> sp.)	2-3	9-13	1	N.A.	N.A.	5.8	N.A.	Upper half	1-3 (♂)	N.A.	Presumably 4	N.A.	N.A.

Like *H. arge*, the present hydroid possesses gonophores with 4 radial canals and 8 tentacle rudiments, but its gastro- and gonozooids are comparatively smaller, and do not show any tendency to autotomize. The Bermudan material assigned by Calder (1988) to the same taxon comes close to our specimens regarding the size of its zooids, the number of their tentacles, and the structure of its medusoid, but its cnidome seems to possess only one type of haplonemes, whilst two additional ones occur in the Martinican hydroid.

The Puerto Rican material identified as *Stylactis arge* by Wedler & Larson (1986) possesses taller zooids with more numerous tentacles, and its medusoids are apparently devoid of tentacle stumps (possibly immature?). The rather brief description, combined with the absence of data on the cnidome, prevents any further comparison from being established with our material.

Hydractinia hooperii, as described originally, has similar medusoids, but its zooids are much taller and possess comparatively more tentacles, thus differing from our material.

The gonozooids of *H. sandrae* (Wedler & Larson, 1986) are said to exhibit a red pigmentary belt between the whorl of tentaeles and the insertion of gonophores, but this was not apparent in our material examined alive (see Pl. 1B). No data on the cnidome of *H. sandrae* were provided by the authors, making impossible any further comparison with our hydroid.

The medusoid-producing *Hydractinia* sp. from Martinique, described earlier by one of us (Galea, 2013), has a different cnidome and, consequently, is not conspecific with the present species.

Last, the as yet unidentified species of *Hydractinia* from Puerto Rico [see Wedler & Larson (1986), p. 95, fig. 10E, as *Stylactis* sp.] is incompletely described, and data on its cnidome is lacking.

In spite of the rather scanty data available, it seems that our material differs morphologically from each of the three nominal species mentioned above, particularly with respect to their original descriptions (subsequent assignments are taken with reserve). According to Schuchert (P. Schuchert, *pers. comm.*), the present species is indistinguishable macroscopically from *H. aculeata* (Wagner, 1833) [see Schuchert (2014)] but, owing to its different substrate selection, remote geographical distribution, and different cnidome composition, it should be kept separate. In addition, none of the remaining species listed in Table 1 is expected to occur in our study area, on the account of their limited dispersal ability due to their characteristic epizoic or epiphytic habit.

Family Tubulariidae Fleming, 1828 Genus *Ectopleura* L. Agassiz, 1862

Ectopleura sp.
Figs 1C-G; 3F-I

Material examined: MHNG-INVE-91110; sample #M294; France, Martinique, Saint Pierre, Tombant de la Galère, 14.75144° -61.18236°, 3 m; 01.02.2014; colony up to 5 cm high with incipient gonophores. — MHNG-INVE-91121; sample #M332; France, Martinique, Saint Pierre, Tombant de la Galère, 14.75144° -61.18236°, 2-4 m; 04.03.2014; colony up to 7 cm high with incipient gonophores.

Description: Stems sparsely branched (no auto-epizootic growth), rarely simple, arising in dense clusters from tortuous, tangled mass of stolonal fibers attached to sand grains (Fig. 1C). Perisarc irregularly annulated, with smooth areas between corrugated patches, thinning out distally. Coenosarc with two longitudinal, endodermal ridges which may meet in the centre. Neck region conspicuously swollen, flexible and contractile, covered basally with filmy perisarc; a narrow, but distinct, transversal band of nematocysts (isorhizas) in middle. Hydranths vasiform; aboral tentacles long, 17-21 (commonly 18) in number, monilifiliform, oval in cross section, especially basally. Oral tentacles short, 14-18 in number, not adnate basally to hypostome, semimoniliform, circular in cross section. About 10-14, short, lobed blastostyles arise slightly above the aboral row of tentacles. Gonophores incipient, their type could not be ascertained. Cnidome: large stenoteles (Fig. 3I¹) in oral tentacles; small and rounded stenoteles (Fig. 3I²) in both oral and aboral tentacles; small and ovoid stenoteles (Fig. 3I³) in both oral and aboral tentacles; microbasic basitrichous isorhizas (Fig. 3I⁴) in both oral and aboral tentacles; O-isorhizas (Fig. 3I⁵) in both oral and aboral tentacles; desmonemes (Fig. 3I⁶) in aboral tentacles.

Dimensions: Stems up to 7 cm high. Hydranths ca. 2.5 mm high, and 7 mm wide between tips of opposite tentacles. Large stenoteles (10.0-10.3)×(8.3-8.6) µm; small and rounded stenoteles (6.6-7.4)×(5.7-6.6) µm; small and ovoid stenoteles (5.7-6.3)× ca. 4.8 µm; microbasic basitrichous isorhizas (8.3-9.1)× ca. 3.4 µm; O-isorhizas (8.0-8.6)×(7.4-8.0) µm; desmonemes (4.3-4.8)×(3.1-3.7) µm.

Remarks: In the absence of fully formed gonophores, the present material could not be identified reliably to species. According to Petersen (1990), six species of *Ectopleura* with a known hydroid stage occur along the Atlantic coast of North America, *viz.* *E. americana* Petersen, 1990, *E. crocea* (L. Agassiz, 1862), *E. dumortieri* (Van Beneden, 1844), *E. grandis* Fraser, 1944, *E. larynx* (Ellis & Solander, 1786), and *E. mayeri* Petersen, 1990. A seventh species, *E. obypa* Migotto & Marques, 1999, was described from Brazil.

Ectopleura americana could be excluded on account of several distinct features: 1) its aboral tentacles are circular throughout in cross-section; 2) the neck region is finely and longitudinally striated; 3) the cauli are unbranched;

4) the 14-24 blastostyles are long, stout, dichotomously branched, and arranged in up to three whorls (Petersen, 1990).

According to various authors (Deevey, 1950; Defenbaugh & Hopkins, 1973; Petersen, 1990), the reduced number of tentacles (never exceeding 16) even in mature, fertile individuals, is diagnostic for *E. grandis*. Our specimens, provided with up to 18 tentacles in the oral whorl, and up to 21 around the hypostome, would not fit the above diagnosis. However, we believe that the tentacle number alone should not be regarded as a reliable character. Unfortunately, no data are available on the cnidome of *E. grandis*. This species is said to reproduce through medusae, though fully mature specimens have never been seen.

The sympatric *E. mayeri* is equally excluded on the account of the characteristic yellow fluorescent tinge of its living hydranths, and the occurrence of microbasic mastigophores in its cnidome (Galea, 2013).

The cnidome of the present species shows affinities with those of *E. crocea* [see Schuchert (1996)], *E. dumortieri* [see Schuchert (2010)], *E. larynx* [see Östman *et al.* (1995)], and *E. obypa* [see Migotto & Marques (1999)], though additional data are necessary to clarify the precise identity of some of the capsules involved. While *E. larynx* is a temperate to cold water species, not expected to occur in tropical environments, our material comes closest to *E. crocea* (P. Schuchert, *pers. comm.*), a species with considerable spreading capabilities due to anthropic activities. *Ectopleura obypa* is different in forming exclusively unbranched cauli, and in having a higher number of tentacles.

Genus *Ralpharia* Watson, 1980

Ralpharia gorgoniae Petersen, 1990

Fig. 2

Ralpharia gorgoniae – Galea, 2013: 10, pl. 1L-O, fig. 2R.

Material examined: MHNG-INVE-91114; sample #M320; France, Martinique, Case-Pilote, 14.6375° -61.13974°, 3 m; 20.02.2014; 5 fertile polyps, 10 female and 20 male medusoids set free.

Description: See the original account by Petersen (1990) and the additional data provided by Galea (2013).

Dimensions: Male medusoids 890-1060 µm (951±49 µm, n=10) long and 755-900 µm (865±41 µm, n=10) wide; female medusoids 1110-1245 µm (1181±43 µm, n=10) long and 1000-1100 µm (1090±41 µm, n=10) wide.

Distribution: Possibly endemic to the Caribbean Sea. Scattered records from some countries bordering the basin are summarized by Galea (2013), but the species is certainly widely-spread within the whole area.

Remarks: The complex structure of the blastostyle, with the gonophores inserted proximally and clusters of nematophores occurring distally (Fig. 2A), is common to three species of the genus, *viz.* *R. neira* Petersen, 1990, *R. rosetta* Watson, 1999, and *R. sanctisebastiani* (da Silveira & Migotto, 1984). Nothing is known about the blastostyles of *R. parasitica* (Korotneff, 1887), nor about its gonophores.

The gonophores of *R. gorgoniae* were illustrated for the first time by Wedler & Larson (1986, as *Tubularia parasitica*), while a short account is available in Petersen (1990). In the present material, the gonophores were liberated from their corresponding polyps within less than an hour, corresponding to the time elapsed between the sampling and their examination in the laboratory. They apparently belong to both sexes, as suggested by differences in their size and color (Fig. 2B). Their anatomy, as described below, shows that we are dealing with eumedusoids. In both sexes, the umbrella is bell shaped, slightly longer than wide. The mesoglea is rather thin (Fig. 2C) and the endoderm is provided with closely-set circular muscle fibers (Fig. 2H). In contrast with the statement by Petersen (1990), who reported only 4 radial canals in his material, each medusoid in the present collection has generally 4-5 (rarely 3 or 6) radial canals, some of which may give off one or two additional, secondary branches, most often a short distance after their origin from the manubrium, but also more distally, on the sides of the umbrella. The bell margin is provided with a raised, internal, thickened collar (Fig. 2C, D), composed of large, polygonal cells (Fig. 2G). No tentacle bulbs or rudimentary tentacles exist. A cross section through the bell margin reveals that the circular canal, of ovoid shape, passes in the middle of the raised collar (Fig. 2F). There is a well-developed velum (Fig. 2D) which, according to the observations made by Wedler & Larson (1986), helps the medusoid swim actively in the plankton. The manubrium is globular to ovoid, not surpassing half of the subumbrellar cavity, and is devoid of a mouth (Fig. 2E). The gonads could not be distinctly seen around the manubrium, especially in formalin-fixed specimens, though in some gonophores which appear to be female, either several flattened eggs or developing larvae could be seen (it is also likely that the gonophores were partly spent prior to the specimen examination). The bell margin, the radial canals, as well as the gonads in living specimens are bright orange in females and yellow-orange in males (Fig. 2B), due to pigment granules disseminated in their tissues. The whole gonophore is entirely devoid of nematocysts. Gonophores provided with a similar raised, internal collar around the bell margin are also known in *R. magnifica* Watson, 1980, *R. neira*, and *R. sanctisebastiani*, but they are absent in *R. coccinea* Watson, 1984, and – apparently – in *R. rosetta*. Four rudimentary tentacle knobs, as well as nematocysts, are present in the medusoids of *R. magnifica* and *R. coccinea*.

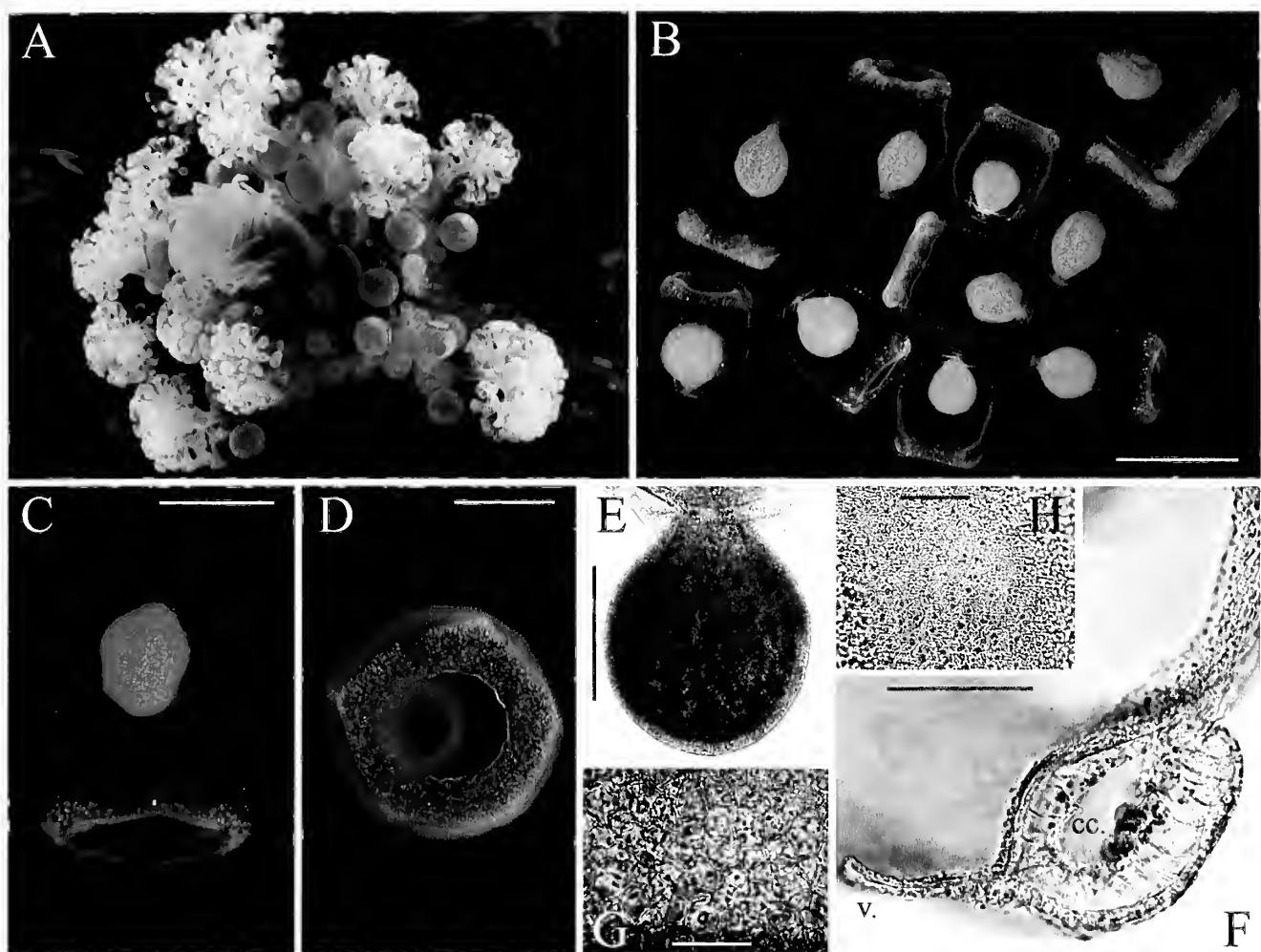


Fig. 2. *Ralpharia gorgoniae* Petersen, 1990. (A) Oral view of a fully fertile polyp. (B) Medusoids of both sexes. (C) Detail of a female medusoid in lateral view. (D) Oral view of a medusoid; note the well-developed velum. (E) Lateral view of a manubrium. (F) Cross section at level of the raised internal collar, showing the velum (v.) and the circular canal (cc.). (G) Microscopical structure of the internal collar, showing accumulation of large, polygonal cells. (H) Microscopical detail of the endoderm, showing closely-set, transverse muscle fibers. Scale bars: 50 µm (H), 100 µm (F, G), 300 µm (E), 500 µm (C, D), and 1 mm (B).

Boero & Bouillon (1989) suggested that, due to their morphological reduction, the gonophores of *R. gorgoniae* could be an example of swimming medusoids among the athecate hydroids. From the available data, it appears that *R. neira*, as well as *R. sanctisebastiani*, satisfy the same condition, in being devoid of marginal bulbs, mouth, and nematocysts.

Order Leptothecata Cornelius, 1992

Family Haleciidae Hincks, 1868

Genus *Halecium* Oken, 1815

Halecium labiatum Billard, 1933

Fig. 3J, K

Halecium labiatum Billard, 1933: 21, fig. 8. – Vervoort, 1967: 30, fig. 4. – Van Praet, 1979: 877, fig. 9. – Rees & Vervoort, 1987: 28, fig. 4C.

Material examined: HRG-1024; sample #M327; France, Martinique, Le Vauclin, Pointe Faula, 14.54064° -60.82837°, 0 m; 23.02.2014; several stems, some bearing female gonothecae, on floating *Sargassum* sp.

Description: See original account by Billard (1933).

Dimensions: Stems 1-2 mm high. Hydrothecae 25-30 µm deep, 95-110 µm wide at base and 115-125 µm wide at rim. Female gonotheca 560-740 µm long. Egg diameter ca. 210 µm.

Distribution: Gulf of Suez (Billard, 1933), and possibly the southern Red Sea (Vervoort, 1967) and the Gulf of Aden (Rees & Vervoort, 1987).

Remarks: The present colony, composed of several minute, irregularly branched stems, is not suitable for a comprehensive redescription of its trophosome.

However, according to Billard (1933) and Van Praet (1979), the stems of *H. labiatum* are up to 2 cm high, monosiphonic throughout, and regularly divided into 660-925 µm long internodes.

The few side branches that exist in our material arise from short lateral apophyses given off just below a stem hydrotheca; they are composed of a single, long and slender internode topped by a hydrotheca. The latter are shallow, with slightly divergent walls and a moderately inwardly rolled margin. Hydranths, when present, badly preserved; the tentacle number and the cnidome composition could not be ascertained properly.

Conversely, the typical morphology of the gonothecae (female in this material) shows that we are undoubtedly dealing with Billard's species. They are given off mostly in pairs (occasionally singly) from below the stem hydrothecae; saccular, with the "dorsal" wall conspicuously bulging, while the "frontal" side is slightly sigmoid. The aperture, placed frontally in the distal half of the gonotheca, is composed of a prominent "lip" recovering a twin hydrotheca from which protrude a couple of hydranths. There are one or two large eggs per gonotheca, and some of them appear to have been fertilized. The lower "lip", according to Billard's wording, is nothing more than the rim of the twin hydrotheca.

The sterile specimens examined by Vervoort (1967) and Rees & Vervoort (1987) possibly belong to the present species, but their occurrence in the same geographical area is not a sufficient argument to justify their identification.

Halecium lightbourni Calder, 1991

Fig. 3L-P

Halecium lightbourni Calder, 1991: 19, figs 10, 11. – ?
Grohmann et al., 2003: 6. – Calder & Kirkendale, 2005: 481.

Material examined: MHNG-INVE-91109; sample #M291; France, Martinique, Saint Pierre, Tombant de la Galère, 14.75144° -61.18236°, 10-15 m; 01.02.2014; male and female colonies epizoic on *Thyroscyphus marginatus* (Allman, 1877).

Description: See original account by Calder (1991).

Dimensions: Stems up to 6 mm high. Female gonothecae 605-810 µm long and 345-420 wide. Oocytes 130-210 µm in diameter. Male gonothecae 355-425 µm long and 135-155 µm wide. Microbasic mastigophores ca. 6.0×1.7 µm; small pseudostenoteles ca. 4.8×2.3 µm; large pseudostenoteles (9.7-10.8)×(4.3-4.6) µm.

Distribution: Bermuda (Calder, 1991), Caribbean coast of Panama (Calder & Kirkendale, 2005). A third record, from Brazil (Grohmann et al., 2003), must be considered as provisional on account of the lack of formal description and figures of the studied material.

Remarks: These small, mostly simple or occasionally branched stems with moderately long and slender internodes and shallow, somewhat flaring hydrothecae, correspond well to the trophosome of *H. lightbourni*, as described by Calder (1991). In addition, the cnidome composition appears to be the same [compare our Fig. 3P with fig. 11 on p. 20 in Calder (1991)]. In our view, the nematocysts are microbasic mastigophores (Fig. 3P¹), as well as small and large pseudostenoteles (Fig. 3P²⁻³). The last two capsules, though none were seen discharged, are provided with conspicuously swollen shafts and resemble the pseudostenoteles observed in other species of *Halecium*. In contrast, Calder (1991) identified them as microbasic euryteles.

The present material is fertile, carrying gonothecae of both sexes on different colonies. They are given off either from below a secondary hydrotheca or from within a hydrotheca. The females are saccular to reniform; their aperture, characteristically tilted outward and upward (Fig. 3M¹), is represented by a twin hydrotheca (Fig. 3M²) from which protrude a pair of normal hydranths. There are 5-6 oocytes per gonotheca (Fig. 3N). The male gonothecae are club shaped (Fig. 3O), thus typical of the genus.

Halecium plicatum Galea, sp. nov.

Fig. 4A-I

Holotype material: MHNG-INVE-91117; sample #M327; France, Martinique, Le Vauclin, Pointe Faula, 14.54064° -60.82837°, 0 m; 23.02.2014; female colony on floating *Sargassum* sp.

Paratype material: MHNG-INVE-91118; sample #M327; France, Martinique, Le Vauclin, Pointe Faula, 14.54064° -60.82837°, 0 m; 23.02.2014; male colony on floating *Sargassum* sp. – MHNG-INVE-91111; sample #M303; France, Martinique, Le Vauclin, Pointe Faula, 14.54064° -60.82837°, 0 m; 11.02.2014; female colony on floating *Sargassum* sp.

Diagnosis: Small, monosiphonic stems; internodes moderately long, with a terminal hydrotheca and a lateral, upwardly-curved, small apophysis supporting following internode. Female gonotheca kidney-shaped, perisarc thick on "dorsal" side, pleated on top, a twin gonotheca on "ventral" side. Nematocysts comprising microbasic mastigophores and pseudostenoteles.

Etymology: The specific epithet *plicatum* is the participle of the Latin *plico* (in Greek, πλέχω), meaning pleated, to characterize the appearance of the perisarc on the summit of the female gonotheca.

Description: Colonies small, upright, arising from creeping, branching and anastomosing hydrorhiza with irregular, internal pegs of perisarc (Fig. 4A). Hydrocauli monosiphonic; basal part composed of 2-3

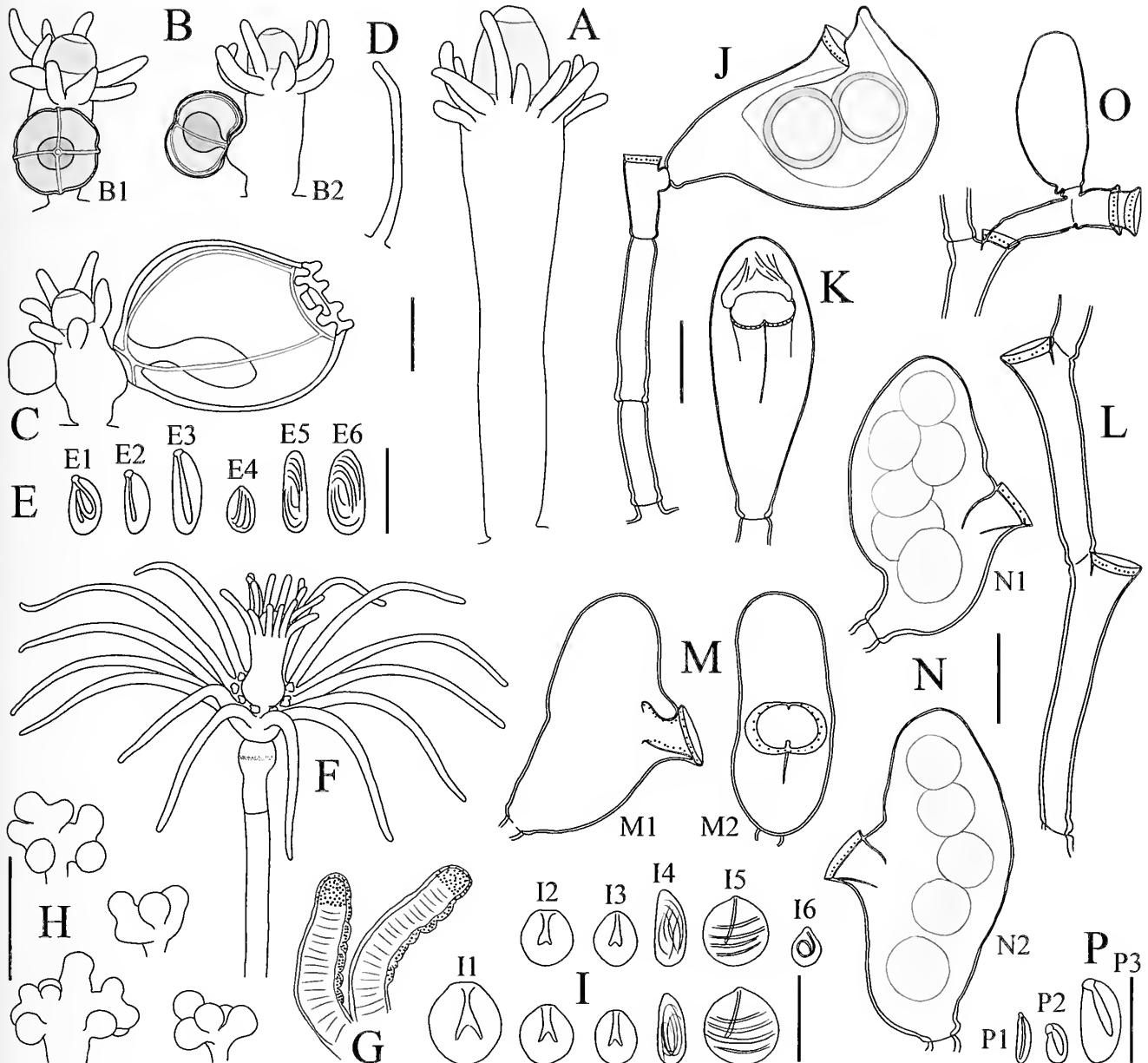


Fig. 3. A-E: *Hydractinia promiscua* sp. nov. (A) Gastrozooid. (B) Same gonozooid with ripe, unspent male gonophore seen both frontally (B¹) and laterally (B²). (C) Gonozooid with spent medusoid in lateral view. (D) Tentaculozoid. (E) Cnidome. F-I: *Ectopleura* sp. (F) Hydranth. (G) Two oral tentacles. (H) Four blastostyles with immature gonophores. (I) Cnidome of both aboral (upper row) and oral (lower row) tentacles. J, K: *Halecium labiatum* Billard, 1933. (J) Female gonotheca in lateral view. (K) Same gonotheca seen frontally. L-P: *Halecium lightbourni* Calder, 1991. (L) Two stem internodes. (M) Same female gonotheca seen both laterally (M¹) and frontally (M²). (N) Two female gonothecae with oocytes. (O) Male gonothecae. (P) Cnidome. Scale bars: 10 µm (E, I, P), 200 µm (J-O), 300 µm (A-D, G, H).

short, cylindrical segments with bulged ends; remainder of cauli divided into slightly geniculate, moderately long and slender internodes, by means of slightly oblique constrictions of the perisarc sloping in alternate directions (Fig. 4B, C); perisarc thin and smooth; each internode swollen basally, with a hydrotheca distally, and 1-2 short, upward-curved apophyses for the insertion of following internodes; apophyses given off from just below the base of a theca. Side branches,

when present, short, composed of only 1-3 internodes (Fig. 4B, C⁶). Short, athecate internodes may be inserted among the normal sequence of thecate internodes (Fig. 4A, B, C¹, C⁹) in various stems. Hydrothecae shallow, walls slightly flaring, rim even, not everted (Fig. 4D); renovations occasional; secondary hydrophores of varied length, basal part with annulated perisarc. Hydranths with ca. 20 filiform tentacles surrounding a conical hypostome. Gonothecae arising with no definite

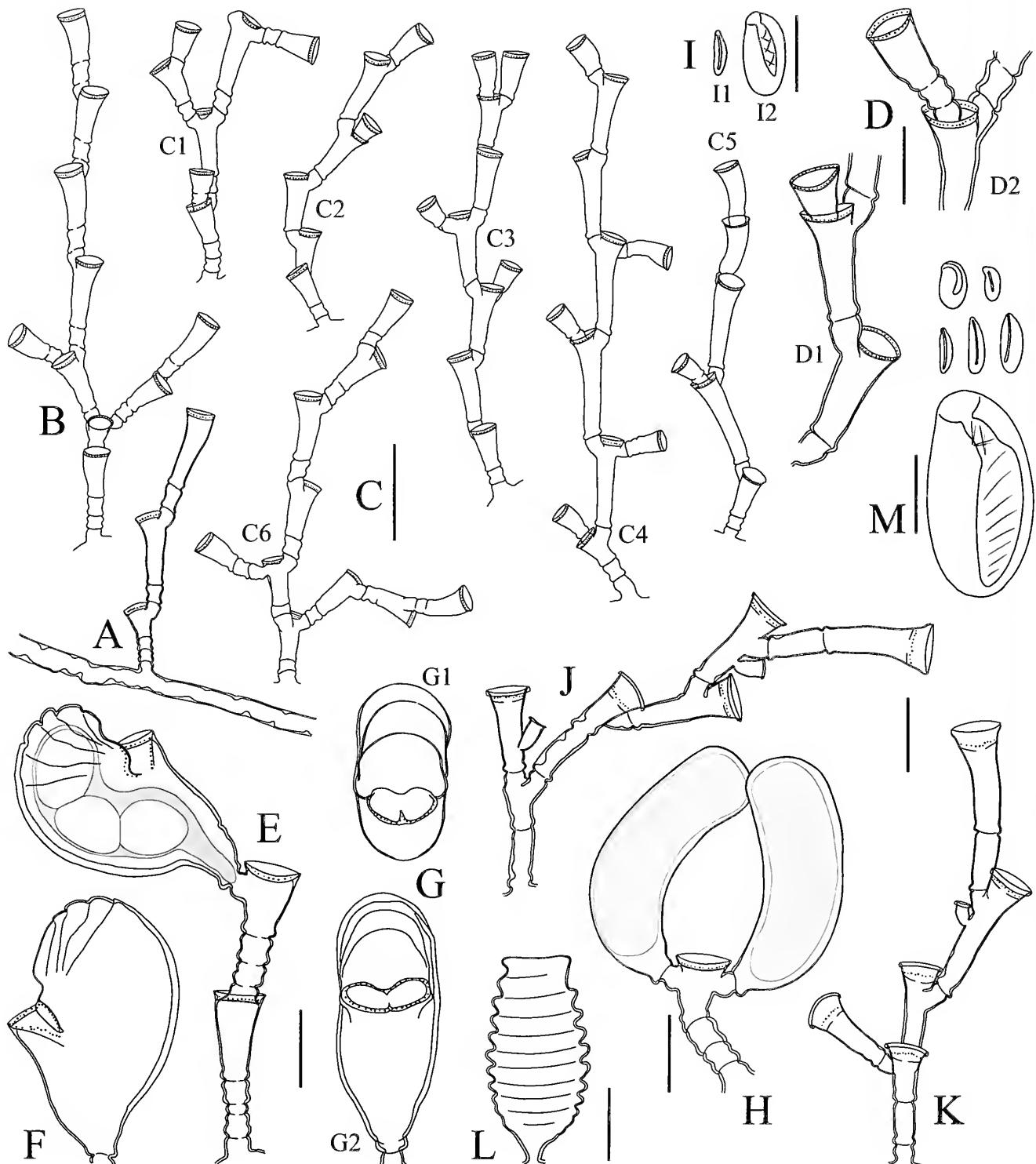


Fig. 4. A-I: *Halecium plicatum* sp. nov. (A) Stolon (note internal pegs) and upright stem. (B) Stem from sample M327. (C) Six stems from sample M303 (note irregular presence of short athecate internodes). (D) Details of internodes with hydrothecae from samples M303 (D¹) and M327 (D²). (E) Female gonotheca, showing oocytes. (F, G) Same female gonotheca seen laterally (F), frontally (G²), and from a plane parallel to the aperture of twin hydrotheca (G¹). (H) Male gonothecae. (I) Cnidome. J-M: *Hydrodendron mirabile* (Hincks, 1866). (J, K) Two erect stems. (L) Male gonotheca. (M) Cnidome. Scale bars: 10 µm (I, M), 200 µm (D-H), 300 µm (J-L), 500 µm (A-C).

pedicel from stem apophyses, similarly to the branches. Female kidney-shaped (Fig. 4E-G), laterally flattened (Fig. 4G²), perisarc thick, especially on “dorsal” side (Fig. 4F), forming apically a number of conspicuous folds; concave side carrying a twin hydrotheca (Fig. 4G²) from which emerges a pair of hydranths; hydrothecae not fused medially, but separated frontally by an internal septum (Fig. 4G¹) plunging, for some distance, into the lumen of gonotheca (Fig. 4F); generally three large eggs per gonotheca. Male gonothecae cylindrical, curved in middle, tapering basally, with rounded top; a compact mass of sperm cells fills nearly completely their lumen (Fig. 4H). Cnidome (Fig. 4I): microbasic mastigophores and likely pseudostenoteles, though none was seen discharged.

Dimensions: Stems up to 3 mm high. Internodes 220-250 µm long and 55-70 µm wide at node. Short athecate internodes (occasionally present) 90-135 µm long. Stem apophyses 80-90 µm long. Hydrothecae ca. 30 µm deep, 115-140 µm wide at base, and 125-160 µm wide at aperture. Female gonothecae 560-660 µm long, 385-400 µm wide. Male gonotheca 600-670 µm long, 215-245 µm wide. Microbasic mastigophores (5.5-6.0)× ca. 1.7 µm; pseudostenoteles (9.5-9.8)×(4.0-4.3) µm.

Distribution: Known only from Martinique (present study).

Type locality: France, Martinique, Le Vauclin, Pointe Faula.

Remarks: Although the hydrocauli and, when present, the side branches are divided into regular sequences of thecate internodes (Fig. 4C²⁻⁵), short, intermediate athecate internodes may be inserted among them (Fig. 4C¹⁻⁶) in some stems, but not in others, as illustrated by the colony from sample M303. Their presence was, however, constant in the colony from sample M327 (Fig. 4A, B).

The specimens of *Halecium* sp. from Guadeloupe [see Galea (2010a), p. 11, Fig. 3P-S], which exhibit a trophosome similar to that of the present species, were re-examined for this study. A more careful analysis of their cnidome revealed that two additional capsules, previously overlooked due to their scarcity, equally occur: a smaller pseudostenotele [(5.9-6.6)×(2.3-2.4) µm], as well as a tubular, slightly curved, heteroneme with rounded ends [(4.7-4.9)× ca. 2.4 µm]. No such capsules were observed in any of the available specimens of *H. plicatum*.

Similarly, the trophosome of the as yet unidentified *Halecium*, mentioned by Galea (2013, p. 20, fig. 5J-M), resembles that of the new species. A re-analysis of its cnidome confirmed the previous observations, proving that it is not only distinct from *H. plicatum*, but also from its Guadeloupean relative.

The mode of branching in *H. plicatum* is equally found in a number of congeners, but these exhibit several distinguishing features enabling their separation from

the new species, as follows: 1) *Halecium conicum* Stechow, 1919 has comparatively deeper and flaring hydrothecae, and the female gonothecae are irregularly ovoid, with a small, distal aperture (Motz-Kossowska, 1911, as *H. minutum* sp. nov.); 2) *H. curvicaule* von Lorenz, 1886 has female gonothecae provided with numerous conspicuous transverse ridges on nearly their whole surface (Calder, 1970); 3) small specimens of *H. dichotomum* Allman, 1888 with sympodial growth habit are distinguished through their hydrothecae with everted rim, and the presence of characteristic wrinkles on the “dorsal” surface of the female gonothecae (Galea, 2013); 4) the female gonothecae of *H. expansum* Trebilcock, 1928 have an entirely smooth surface and their aperture is provided with a “large, slit-like opening flanked on each side by [a] gutter-shaped flap supporting a hydranth” (Vervoort & Watson, 2003); 5) *H. fragile* Hodgson, 1950 has exceedingly long and slender internodes (Watson & Vervoort, 2001); 6) *H. interpolatum* Ritchie, 1907 is a large species, with polysiphonic stems, exceedingly long and slender internodes (Peña Cantero, 2014), and its female gonothecae are broadly ovoid, with a rounded, distal aperture (Watson, 2008); 7) the coenosare of *H. nanum* Alder, 1859 is filled with zooxanthellae, and its female gonothecae have an almost distal aperture, whose closely appressed tubes are finely annulated (Calder, 1991); 8) the hydrothecae of *H. pygmaeum* Fraser, 1911 have everted margins, and its female gonothecae are smooth-walled and contain ca. 7 oocytes (Hirohito, 1995); 9) the internodes of *H. scalariformis* Billard, 1929 are very short and annulated basally (Billard, 1929); 10) the female gonothecae of *H. speciosum* Nutting, 1901 are ovoid in general outline and transversely annulated, and the distal part of the internodes may be wrinkled (Nutting, 1901); 11) the internodes of *H. tenellum* Hincks, 1861 are long, slender and strongly geniculate, its hydrothecal rim is greatly outrolled, and the female gonothecae are pear-shaped and contain a larger number of oocytes (Calder, 1991; Galea et al., 2007); 12) the internodes of *H. vagans* Fraser, 1938 are exceedingly long and slender, and the hydrothecal margin is almost flaring (Fraser, 1938). Short, athecate internodes, like those of *H. plicatum*, are also inserted among the thecate internodes of several other species of the genus, but a number of morphological characters distinguish them from the new species, as follows: 1) the hydrothecae of *H. arcticum* Ronowicz & Sehuehert, 2007 are comparatively deeper and have an everted margin, and its female gonothecae are discoid, with an apical aperture flanked by two lateral horns (see original description); 2) the stems and branches of *H. lankesterii* (Bourne, 1890) are more irregularly segmented, its coenosare contains zooxanthellae, and the female gonothecae are smooth-walled (Schuchert, 2005); 3) *H. luteum* Watson, 1975 has strongly fascicled stems, its internodes are short, the hydrothecal rim is outrolled, and there is a “wedge-shaped thickening of the perisarc” below the diaphragm (Watson, 1975).

Female gonothecae with the overall shape of those of *H. plicatum* are present in other species of the genus. The main features allowing their distinction from the new species are as follows: 1) the gonothecae of *H. beanii* (Johnston, 1838) are smooth-walled, and this is a large species with polysiphonic stems, rather short internodes, and apophyses in continuation of the long axis of internode, the hydrotheca being displaced laterally (Hirohito, 1995); 2) *H. bermudense* Congdon, 1907 forms large colonies with polysiphonic stems, its internodes are almost collinear, the apophyses are in continuation of the long axis of internode (the hydrothecae being displaced laterally), the female gonotheca is entirely smooth (Migotto, 1996), and its cnidome is different (Calder, 1991); 3) the gonotheca of *H. bithecum* Watson, 2005 is entirely smooth and its aperture is more tubular, the stems may be slightly polysiphonic, and the hydrothecae are borne on well-developed hydrophores (Watson, 2005); 4) *H. fjordlandicum* Galea, 2007 forms pinnate colonies with polysiphonic stems, the internodes are very long and slender, the cnidome is different (Galea, 2007), and its gonothecae are smooth-walled and much curved (Galea & Schories, 2012); 5) colonies of *H. jaederholmi* Vervoort, 1972 are large and polysiphonic, the hydrothecae are characteristically adnate to their corresponding internodes, and the gonothecae are entirely smooth (Vervoort, 1972; Millard, 1977); 6) *H. macrocephalum* Allman, 1877 has polysiphonic stems, the apophyses are a continuation of the long axis of internode, its hydrothecae being displaced laterally and tilted downwards to about 45°, and the gonothecae have a smooth surface (Allman, 1877; Vervoort *et al.*, 2011); 7) *H. scutum* Clark, 1877 forms large, polysiphonic colonies, its internodes are short, the apophyses are minute, and the gonothecae are entirely smooth, with the aperture “partially covered by a characteristic hood-like process” (Schuchert, 2005); 8) the internodes of the large, polysiphonic *H. sessile* Norman, 1867 are collinear, gradually widening distally, and their gonotheeae are smooth-walled (Cornelius, 1975); 9) the gonotheeae of *H. tabulatum* Watson, 2005 are smooth, their aperture is a “deep slightly inwardly tilted shelf containing a reduced hydranth”, and its hydrothecae expand to margin, where the rim is weakly everted (Watson, 2005).

Genus *Hydrodendron* Hincks, 1874

Hydrodendron mirabile (Hincks, 1866)

Fig. 4J-M

Material examined: MHNG-INVE-91105; sample #M135; France, Martinique, Anse Dufour, 14.52716° -61.09003°, 0-1 m; 23.01.2014; male colonies on benthic *Sargassum* sp.

Description: See Hirohito (1995).

Distribution: Numerous records assigned to *H. mirabile* and its putative synonym, *H. caciniformis* (Ritchie, 1908), are mostly based on sterile specimens whose specific identity could not be ascertained properly (Galea *et al.*, 2014). Records based on fertile material corresponding to the concept of *H. mirabile* defined by Galea *et al.* are from the Mediterranean, Caribbean (present report), Korea (Rho & Park, 1980), and Japan (Hirohito, 1974; 1995).

Remarks: A recent account on the present material, including a comparison with Mediterranean specimens of *H. mirabile*, is provided by Galea *et al.* (2014).

Family Sertulariidae Lamouroux, 1812

Genus *Dynamena* Lamouroux, 1812

Dynamena bimorpha Galea, sp. nov.

Fig. 5A-F, Table 2

? *Dynamena cornicina* – Millard, 1964: 29, fig. 9; 1975: 261, fig. 86A-E (not *Dynamena cornicina* McCrady, 1859).

Holotype material: MHNG-INVE-91119; sample #M327; France, Martinique, Le Vauclin, Pointe Faula, 14.54064° -60.82837°, 0 m; 23.02.2014; sterile colony with simple and pinnately-branched stems, on floating *Sargassum* sp.

Diagnosis: Simple and pinnate stems within the same colony; eladia alternate; stem internodes with a basal, lateral apophysis, an axillary hydrotheca, as well as two hydrothecae alternately-placed above; hydrothecae on cladia in strictly opposite pairs; gonotheeae transversely ribbed.

Etymology: From the Latin *bis*, meaning double, and the Greek μορφή, meaning shape, to make an allusion to the co-occurrence of two growth forms in this species.

Description: Colonies erect, arising from a creeping, branching stolon. Stems either simple (Fig. 5A) or pinnately-branched (Fig. 5B). Simple stems with a short basal part devoid of hydrothecae, ending in oblique node; above, stem divided into up to 12 internodes by collar-like constrictions of the perisarc; each internode with a pair of opposite hydrothecae, these separated in basalmost internodes, becoming gradually contiguous distally; adnate for half their adaxial length; pairs of hydrothecae fairly close along internode. Abcauline wall thickened just below margin.

Pinnate stems with a basal, athecate part ending in an oblique hinge joint, or with an additional segment bearing one or two pairs of subalternate hydrothecae. Above, stem divided into up to 10 regular internodes by transverse constrictions of the perisarc. Internodes geniculate, with a proximal apophysis supporting a cladium, and three hydrothecae: one in the axil formed by the apophysis with the internode, and two alternate

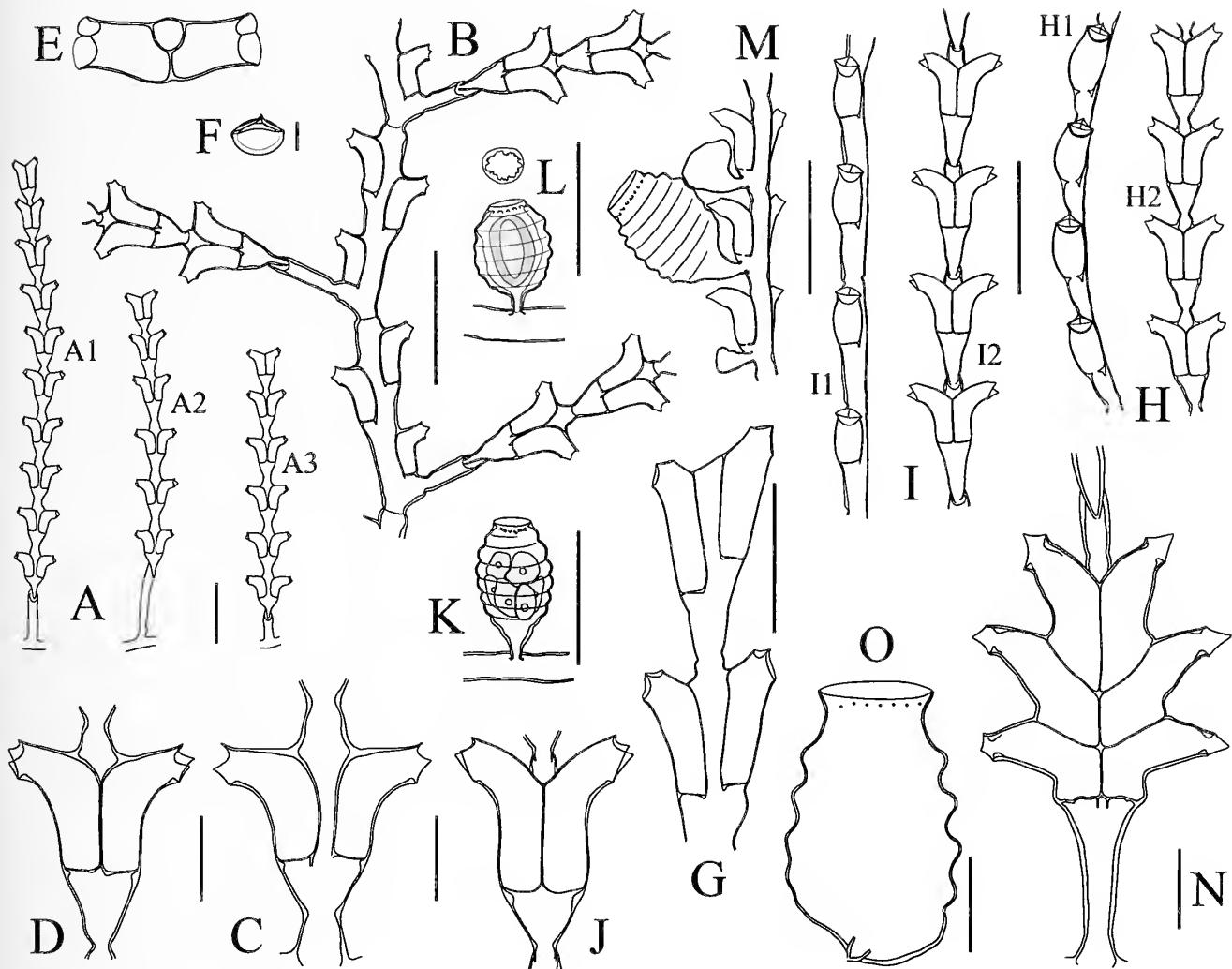


Fig. 5. A-F: *Dynamena bimorpha* sp. nov. (A) Three simple stems. (B) Detail of a pinnate stems, showing the stem internodes and the basal parts of three cladia. (C, D) Hydrothecal pairs from basalmost internode (C) and from a more distal internode (D) of a simple stem, and comparison with hydrothecae of *D. disticha* (Bosc, 1802) (J). (E) Hydrothecal pair seen from above, showing small, adaxial teeth. (F) Aperture of a hydrotheca seen frontally, showing pleated adaxial opercular flap, and a slightly larger, abaxial flap. G: Type material of *D. tropica* Stechow, 1926. H-M: *D. disticha*. (H, I) Stem from Martinique in lateral (H¹) and frontal (H²) aspect compared with stem from the Mediterranean in lateral (I¹) and frontal (I²) views. (K, L) Female (K) and male (L) gonothecae from Martinican material. (M) Gonotheca on basal part of stem from the Mediterranean. N, O: *Dynamena quadridentata* (Ellis & Solander, 1786). (N) Internode with stacked hydrothecae. (O) Gonotheca. Scale bars: 100 µm (E, F), 200 µm (N), 300 µm (C, D, J, O), 500 µm (G), and 1 mm (A, B, H, I, K-M).

above; apophyses prominent, given off alternately from opposite sides of caulus. Cladia unbranched, straight; left and right rows of cladia coplanar; there is a basal, athecate internode separated by a transverse node from the apophysis, and by an oblique node distally; remainder of cladium with exactly the same structure as the simple stems; with up to 10 pairs of hydrothecae. Stem hydrothecae adnate for two-thirds their adcauline length; abaxial wall straight basally and convex distally; adaxial wall convex medially, straight to curved in its immersed portion, then nearly straight distally. Perisarc of hydrotheca thickened toward aperture, especially on abaxial side. Aperture ovoid, facing outward and

slightly upward; margin with two prominent lateral pointed eusp, and a smaller median one adaxially. Operculum composed of a large, abaxial valve and a slightly smaller one, divided medially by crease line. Hydranth with no abaxial eaecum. Gonothecae absent.

Dimensions: Simple stems up to 8 mm high; internodes 650-855 µm long and 75-125 µm wide at nodes; free adcauline wall of hydrotheca 175-240 µm, adnate adcauline part 400-455 µm, abcauline wall 340-390 µm long, base width 130-155 µm, aperture 125-140 µm wide. Pinnate stems up to 2 cm high; internodes 1295-1545 µm long and 135-220 µm wide at nodes; apophyses 170-210 µm long; first cladal segments 430-

Table 2. Comparison between *Dynamena bimorpha* sp. nov. and its congeners. The abbreviations used are as follows: for the stems, H (height); for the hydrothecae, AA (adnate adaxial side), FA (free adaxial side), Ad (whole adaxial side), Ab (whole abaxial side), φ (diameter at aperture); for the gonotheca, L (length), W (maximum width), ϕ (diameter at aperture).

Species name	Reference(s)	Condition of stem	Stem internodes	Cladial internodes	Particulars of hydrothecae	Gonotheca	Distribution
<i>D. anceps</i> (Fraser, 1938)	Fraser (1938), Calder <i>et al.</i> (2009)	Pinnate (opposite cladia), H < 4 cm	Regular, (?) with two pairs of successive hydrothecae	No data available	Opposite though not in contact, long, tubular, adnate for 1/3 their length	Unknown	Pacific off Ecuador, Panama, Mexico
<i>D. bilamellata</i> Watson, 2000	Watson (2000)	Simple, H < 10 mm, ca. 11 pairs of hydro- thecae	Each with one pair of hy- drothecae, L = 336-440 µm	No cladia	Opposite, in contact in front of stem, > 1/2 adnate, 2 prominent internal shelves, AA = 92-136 µm, FA = 80-96 µm, Ab = 144-160 µm, φ = 60-64 µm	Unknown	N Australia
<i>D. bimorpha</i> sp. nov.	Present study, Millard (1975)	Simple, H < 8 mm; pinnate (alternate cladia), H < 2 cm	With a proximal apophysis, an axillary hydrotheca, and 2 other subopposite thecae above	Each with a pair of opposite hydro- thecae	Pairs separated to contiguous in sim- ple stems; contiguous on cladia; FA = 175-240 µm, AA = 400-455 µm, Ab = 340-390 µm, φ = 125-140 µm	Given off from hydrorhiza or from stem bases; ovate, transversely an- nulated, aperture broad, operculum flat; L < 1400, W < 900	Caribbean, South Africa
<i>D. brevis</i> (Fraser, 1935)	Fraser (1935), Hirotito (1995)	Simple, occasionally a branch, H < 7 mm	Each with a pair of hy- drothecae	No cladia	Opposite, adnate for < 1/2, bending outward nearly at right angle with stem, AA = 180-220 µm, φ = 80- 100 µm	On basal part of stem or on stolon, elongate ovoid, L = 1250-1350 (♂), W = 650-750 µm (♂), with 6-7 transverse ridges, aperture large, on well-developed collar	Japan
<i>D. crisioides</i> Lamouroux, 1824	Calder (1991)	Regularly pinnate (alternate), H < 5 cm	With a proximal apophysis, an axillary hydrotheca, and 1-3 pairs of subopposite thecae above	Of varied length, with 1-3 pairs of hydrothecae	Subopposite on cladia, elongate, tubular, deeply immersed, AA = 336-503 µm, FA = 75-196 µm, Ab = 317-419 µm, φ = 112-121 µm	Vase-shaped, L = 1021-1170 µm, W = 404-89 µm, φ = 200-230 µm, walls smooth, aperture at end of long, narrow, flaring collar	Circumglobal in tropical and sub- tropical waters
<i>D. dalmasi</i> (Versluys, 1899)	Medel & Ver- voort (1998), Calder (1991)	Simple or occasion- ally and irregularly branched, H < 7.6 cm	Long (947-1106 µm), with 1 opposite pair of hydro- thecae distally	Structure as the stem	Pairs either separated or contiguous, cylindrical, curved outwards, Ad = 461-504 µm, Ab = 266-336 µm, internal cusps distinct or not	Unknown	Circumglobal in tropical and sub- tropical waters
<i>D. decipiens</i> (Levinsen, 1913)	Levinsen (1913), Watson (2000), as <i>D. mertoni</i>	Regularly pinnate (al- ternate), H < 2.2 cm	With a basal apophysis, an axillary hydrotheca, and two other alternating thecae above, L = 720-1160 µm	With grouped, overlapping, multi- ple pairs of hydro- thecae	Opposite on cladia, long, tubular, AA = 400-544 µm, FA = 168-200 µm, Ab = 520-544 µm, φ = 120-156	Grouped on proximal stem, barrel shaped, L = 1700-1780 µm, W = 800-900 µm, φ = 480-496 µm, cor- rugated to almost smooth, a slightly everted collar	India, N Australia
<i>D. dispar</i> (Fraser, 1938)	Fraser (1938), Calder <i>et al.</i> (2009)	Simple, H < 1 cm	Each with a pair of medial- ly placed hydrothecae	No cladia	Opposite, stout for their reduced length, with fine striations	On basal part of stems, barrel shaped, L = ca. 1200 µm, W = ca. 800 µm, walls transversely ringed, distally truncate, aperture wide	Pacific off Ecua- dor, Baja Cali- fornia
<i>D. disticha</i> (Bosc, 1802)	Calder (1991), present study	Simple, H < 1 cm	Each with a pair of hydro- thecae, L = 401-895 µm	No cladia	Vasiform L = 880-1015 µm (♀) and 725-815 µm (♂), W = 545-605 µm (♀) and 565-605 µm (♂), with 5-6 spiral grooves, aperture wide, on short collar	Circumglobal in temperate to tropical seas	
<i>D. fissa</i> (Thornley, 1904)	Thornley (1904), Billard (1925)	Branching irregular to dichotomous, H < 7.6 cm	No nodes, hydrothecae in well separated pairs or triplets, branches given off from before and behind a pair of thecae	Structure as the stem	Opposite, contiguous or not, stout for their reduced length, AA = 310- 340 µm, FA = 230-285 µm, Ab = 355-385 µm, φ = 105-115 µm	On stems and branches, broadly ovoid, strongly annulated aperture large, on broad neck	Sri Lanka, Indo- nesia

Species name	Reference(s)	Condition of stem	Stem internodes	Cladial internodes	Particulars of hydrothecae	Gonotheca	Distribution
<i>D. griffini</i> (Hargitt, 1924)	Hargitt (1924)	Mostly simple, occasionally branched, H < 9 mm	With more than one pair of hydrothecae	When present, presumably as the stem	Cylindrical, curving outward distally, adnate for 2/3, generally in groups of two	Borne on stem internodes, urn-like, tapering below, a narrow neck, aperture rather small for the genus	Philippines
<i>D. heterodonta</i> (Jarvis, 1922)	Jarvis (1922); Billard (1925)	Simple, H < 15 mm	With one (proximally) or more (distally) pairs of opposite hydrothecae	No cladia	Cylindrical, strongly curving outwards, AA = 215-250 μm , FA = 160-240 μm , φ = 70-90 μm , submarginally	Below proximal pair of hydrothecae, vaseform, with c. 5 annular ridges, truncate distally	Carcados, Gambier, Borneo, Sumbawa
<i>D. japonica</i> Stechow, 1920	Hirohito (1995)	Pinnate (opposite), H < 20 cm	Each with a pair of cladial apophyses and 3-4 pairs of opposite hydrothecae	Varied length, 1-3 pairs of opposite hydrothecae	Pairs not contiguous, tubular, almost fully immersed in internode, Ad = 550-600 μm , φ = 200-250 μm	On hydrocladia, elongate, L = 1500-1600 μm , W = 700-800 μm , tapering below, aperture wide, on short collar	Japan
<i>D. moluccana</i> (Picet, 1893)	Billard (1925); as <i>D. cornicina</i> ; Schuchert (2003)	Pinnate (alternate), H < 6 cm	Each with a lateral apophysis, and 3 alternate hydrothecae	Each with a pair of opposite hydrothecae	Long, tubular, adnate for 2/3, AA = 375-515 μm , FA = 215-265 μm , φ = 125-180 μm , axillary hydrothecae exceedingly curved outward	On stems and stolons, urn-shaped, L = ca. 1000 μm , W = ca. 700 μm , walls smooth to undulated, aperture wide, on short distal neck	From South Africa to Marshall islands
<i>D. nanhaensis</i> Tang, 1991	Tang (1991)	Simple, H < 10 mm	Each with generally one (occasionally 2) pair(s) of hydrothecae, L = 520-540 μm	No cladia	Long, tubular, with parallel walls basally, adnate for 1/2-3/4, distal part curved outwards, AA = 210-280 μm , FA = 70-150 μm , Ab = 240-320 μm , φ = 90-110 μm	Unknown	Southern China
<i>D. obliqua</i> Lamouroux, 1816	Millard (1958, 1975); Hirohito (1995)	Simple, H < 17 mm	Irregular, each bearing generally 1 (but up to 4) pairs of opposite hydrothecae	No cladia	Opposite, less tendency towards grouping, moderately long, swollen, AA = 270-380 μm , FA = 120-160 μm , φ = 120-140 μm , submarginal cusps occasionally present	Near base of stem, barrel-shaped, with 5-8 transverse annulations, aperture broad on short neck, L = 1400-1600 μm ($\varphi > \delta$), W = 650-700 μm	Australia, Indonesia, S Africa
<i>D. ogasawara-</i> <i>rana</i> Hirohito, 1974	Hirohito (1974)	Simple, H = ca. 2.5 mm, with 7-8 pairs of hydrothecae	Each with a pair of hydrothecae, L = ca. 300 μm	No cladia	Opposite, adnate for 1/2, free part at 60° to internode, 2 internal inconspicuous cusps, AA = 110-160 μm , FA = 110-150 μm , φ = 50-60 μm	On proximal internodes, ovoid, L = ca. 500, W = ca. 300 μm , walls smooth, distal end truncate, aperture wide, on short collar	Japan
<i>D. pumila</i> (Linnaeus, 1758)	Cornelius (1979)	Unbranched to sparsely and irregularly branched, H < 7.5 cm	Each with 1-3 pairs of hydrothecae, L = 600-920 μm (one pair)	Structure as the stem	Opposite to sub-opposite, tubular, curved outwards, 2/3 adnate	Borne on stems and branches, ovoid, wall sometimes slightly undulated, aperture wide on short neck, L = 1200-1400 (φ) and 1400-1500 μm (δ), W = 620-670 (φ) and 570-600 (δ)	Cool to temperate N Atlantic
<i>D. quadriden-</i> <i>tata</i> (Ellis & Solander, 1786)	Calder (1988); present study	Simple, H < 13 mm	Varied in length, with 1-7 pairs of hydrothecae	No cladia	Pairs of hydrothecae stacked in groups, usually with internal cusps, Ab = 168-289 μm , φ = 84-98 μm	Urn-shaped, L = 865-1000 μm , W = 500-600 μm , 4-5 transverse ridges, aperture wide (360-400 μm), on short collar	Circumglobal in tropical and subtropical waters
<i>D. spinosa</i> Watson, 2005	Watson (2005)	Simple, H < 6 mm	Of varied length, comprising a succession of subopposite hydrothecae	No cladia	Pairs widely separated frontally, flask-shaped, narrowing to margin, adnate for > 1/2, AA = 137-152 μm , FA = 98-105 μm , Ab = 172-195 μm , φ = 98-105 μm	Um-shaped, L = 1098-1235 μm , W = 672-806 μm , walls smooth, aperture flanked by two opposite horns	W Australia

545 µm long; free adeauline wall of hydrotheca 175–205 µm, base of hydrotheca 110–120 µm wide, aperture 120–135 µm wide; adnate wall of hydrotheca 330–365 µm in axillar thecae, and 415–450 µm in the others; abcauline wall of hydrotheca 275–310 µm in axillar thecae, and 340–380 µm in the others.

Distribution: Martinique (present study) and, possibly, South Africa (Millard, 1975).

Type locality: France, Martinique, Le Vauclin, Pointe Faula.

Remarks: This species was first mistaken for a peculiar variant of *D. disticha* in which, in addition to the commonest, simple stems, a pinnate growth form was also present. Both species co-occurred at the same station and on the same substrate, a floating *Sargassum*. However, a careful examination revealed that the coenosarc of the former is bright yellow, even in fixed material (a supposedly positive reaction with iodine was obtained, suggesting that it may carry zooxanthellae), while it is white to transparent in *D. disticha* [however, this species may also carry symbiotic algae, as the living specimens originally described by Bosc (1802, p. 101) exhibited a yellow tinge: “*Le tout de couleur jaune*”]. In addition, its perisarc is comparatively thicker and not collapsible like that of *D. disticha*, and its hydrothecae are less deep and much wider than in Bosc’s species (compare Fig. 5C, D with Fig. 5J).

True branched colonies were never reported in *D. disticha*, and all records assigned to this species, especially those from the Indo-Pacific, should be referred, with little doubt, to *D. moluccana* (Pictet, 1893), as already stated by Schuchert (2003). Only aberrant ramifications, but not pinnate stems, have been rarely observed in *D. disticha*, and these were given off either from within the hydrothecae (Vannucci Mendes, 1946) or from the stem, below a hydrothecal pair (Schuchert, 2003). There are, to our knowledge, two additional and rather curious records of specimens assigned to *D. disticha*, in which sparingly branched colonies occurred: one is from off the Western Sahara (Leloup, 1937) and the other from off Senegal (Picard, 1951). However, the scant data available from these accounts proved inconclusive, but one can imagine that the formation of aberrant branches, similar to those described by Vannucci Mendes and Schuchert, may have been involved.

The South African material with rather tall (up to 6 cm high), pinnate stems described by Millard (1975) under *D. cornicina* McCrady, 1859 is indistinguishable from the present species. In the specimens with simple stems studied by Millard (1964), the shape of the hydrotheca (especially its degree of curvature) varies between the basalmost and the distalmost internodes, exactly as in our material. Though not clearly stated by Millard (1975), it is assumed that gonothecae were only found in her colonies with simple stems [note that fig. 9D in Millard

(1964) was reproduced subsequently as fig. 86E in her 1975 monograph]. Reportedly, the gonothecae arise from the hydrorhiza or occasionally from the stem bases; “ovate, transversely annulated, with broad aperture and flat operculum, reaching 1.4 mm in length and 0.9 mm in maximum diameter” (Millard, 1975).

The main distinguishing features between *D. bimorpha* and its relatives are summarized in Table 2.

Unlike *D. bimorpha*, two congeners, *D. anceps* (Fraser, 1938) and *D. japonica* Stechow, 1920, form pinnate stems with opposite side branches. In contrast, three other species form pinnate colonies with alternate side branches: *D. crisioides* Lamouroux, 1824, *D. decipiens* (Levinsen, 1913), and *D. moluccana* (Pictet, 1893). In the former, the hydrothecae are alternately placed on the hydrocladia, and not oppositely, as in the present hydroid; in the second, the two rows of cladal hydrothecae are displaced to one side, recalling the genus *Hydrallmania* Hincks, 1868 [see also below the remarks on the material assigned to *Sertularia mertoni* Stechow, 1923 by Watson (2000)]; in the third, the axillar hydrothecae is conspicuously bent outwards, the stem internodes are longer, as well as the distance between the hydrothecae they carry (Galea, personal observations on Indonesian material).

The typically dichotomous branching pattern of the stems of *D. fissa* (Thornely, 1904) gives the colonies the appearance of loose, tangled masses (Billard, 1925). Although the stems of *D. pumila* (Linnaeus, 1758) may adopt a simple appearance, they are mostly branched irregularly to occasionally loosely pinnately, and the hydrothecae are set in strictly opposite pairs on both the stems and side branches (Cornelius, 1979).

Unlike *D. bimorpha*, the following nominal species with exclusively simple stems show a more or less pronounced tendency for grouping of their pairs of hydrothecae: *D. obliqua* Lamouroux, 1816, *D. nanshaensis* Tang, 1991, *D. griffini* (Hargitt, 1924), *D. heterodonta* (Jarvis, 1922), and *D. quadridentata* (Ellis & Solander, 1786). Their taxonomic status, especially with respect to the latter nominal species, is uncertain, as most exhibit more or less pronounced morphological intergradations, with no clear cut distinction between them.

The hydrothecae of *D. bilamellata* Watson, 2000 are characterized by the presence of two conspicuous, internal, ad- and abcauline shelves (Watson, 2000).

According to the latest available description (Hirohito 1995), the hydrothecae of *D. brevis* (Fraser, 1935) appear comparatively smaller and less deep than those of *D. bimorpha*; though generally unbranched, a specimen with a lateral branch, given off from below a pair of stem hydrothecae and similar in structure to the caulus, was reported by Hirohito.

The most distinctive feature of *D. dalmasi* (Versluys, 1899) lies in its long stem internodes, each bearing a hydrothecal pair distally (Vervoort, 1959, as *D. mayeri*; Calder, 1991; Medel & Vervoort, 1998). Some colonies

may be branched irregularly (Medel & Vervoort, 1998). The original account on *D. dispar* (Fraser, 1938) offers few distinguishing traits for this species, except perhaps the fact that the hydrothecae are stout for their length, apparently less deep than those of *D. bimorpha* [compare fig. 62A, B in Fraser (1938) with our Figs 5A-D]. Calder *et al.* (2009), who reexamined the type, added that their surface was covered with fine striae.

Dynamena ogasawarana Hirohito, 1974 is a much smaller species (see Table 2), and its gonothecae are smooth-walled, thus differing from those illustrated by Millard (1964).

Dynamena spinea Watson, 2005 lacks regular nodes, each equivalent of internode being rather long, increasing in diameter distally, where it merges imperceptibly into a pair of subopposite hydrothecae. The laterally flattened gonotheca exhibits two peculiar, lateral horns flanking a distal aperture (Watson, 2005), suspiciously recalling the gonotheca of *Amphisbetia olseni* Watson, 1973 (see original description of the latter; note also several common features of their respective trophosomes).

Through the courtesy of B. Ruthensteiner of the Zoologische Staatssammlung of Munich, Germany, one of us (HRG) was provided with several photomicrographs of the type of *D. tropica* Stechow, 1926 (a line drawing derived from one of them is illustrated here in Fig. 5G). There is no doubt that these two pairs of hydrothecae belong to a colony of *D. crisioides*. Consequently, *D. tropica* should be regarded as a junior synonym of Lamouroux' (1824) species.

As a final remark, we would like to draw readers' attention concerning a possible misidentification of a poorly known species, *D. decipiens*, mentioned above in this work. Indeed, Watson (2000) assigned material from North Australia to *Sertularia mertoni* Stechow, 1923, using a genus transfer to *Dynamena* Lamouroux, 1812. However, according to Stechow, his species gives off only a few cladia, and this in a very irregular manner (every 8-35 stem hydrothecae, a 6-cm high stem having at most 4 cladia), while the Australian material possesses stems with a regular structure, each internode bearing 3 hydrothecae and a cladal apophysis. In addition, Stechow stated that there was apparently an abaxial caecum, which justifies the assignment of his species to *Sertularia*. His measurements of the hydrothecae suggest that they are about two times smaller than those in Watson's material. Only the structure of cladia, characterized by a *Hydrallmania*-like insertion of the hydrothecae, is shared by the two species. It is likely that Watson's material belongs instead to *D. decipiens* (Levinsen, 1913), originally described from India. Indeed, among their common features, the following ones are noteworthy: 1) colonies in both materials have the same size (*ca.* 2 cm high); 2) the stems are regularly pinnate, each internode bearing a lateral apophysis and 3 hydrothecae; 3) there is often one pair (occasionally two) of opposite cladia in the basalmost segmented part

of the stem; 4) the cladal internodes are composed of 1-4 hydrothecae; 5) the thecae are characteristically stacked and shifted on to one side of the internode; they are long, tubular, adnate for 2/3rd their length, their free part curving outwards. No morphological differences could be noted between Watson's fig. 12 C & D and Levinsen's figs 12 & 11 (Pl. IV), respectively. Note also that there is at least another, earlier record of *D. decipiens* from Australia (Jäderholm, 1916).

Dynamena disticha (Bosc, 1802)

Fig. 5H-M

Material examined: HRG-0868; sample #M153; France, Martinique, Schoelcher, off Madiana Beach, 14.61142° -61.09922°, 2-4 m; 06.02.2012; male and female colonies on *Syringodium* sp. – HRG-0869; sample #M314; France, Martinique, Le François, Pointe Jacob, 14.58552° -60.84993°, 0 m; 18.02.2014; fertile colonies, sex undeterminable (gonothecae already spent), on floating *Sargassum* sp. – HRG-0573; France, Cassis, Port Pin creek, 43.20323° 5.51105°, 0-1 m; 13.07.2011; fertile colony (sex undeterminable, gonothecae spent) on mineral concretions and algae.

Description: Refer to Calder (1991).

Dimensions: Female gonotheca 880-1015 µm high, 545-605 µm in maximum diameter, 245-280 µm wide at aperture. Male gonotheca 725-815 µm high, 565-605 µm in maximum diameter, 265-290 µm wide at aperture.

Distribution: Circumglobal in tropical, subtropical and temperate waters (Peña Cantero & García Carrascosa, 2002). The Caribbean records are summarized by Calder & Kirkendale (2005).

Remarks: Galea (2008) described aberrant gonothecae arising from within the hydrothecae in specimens from Guadeloupe. Subsequently, fertile material of both sexes became available from Martinique. There is a slight sexual dimorphism in the gonothecae, with the females being a bit longer than the males (see measurements below).

It is interesting to note that, in the populations of *D. disticha* from the western Atlantic, the gonothecae arise in groups from the stolons, close to the origin of stems, as illustrated by specimens from Brazil (Miranda *et al.*, 2011), Colombia (Flórez González, 1983, as *D. cornicina*), Caribbean Sea (Leloup, 1935, as *D. cornicina*; present study, Fig. 5K, L), Gulf of Mexico (Defenbaugh & Hopkins, 1973), and the Atlantic coast on North America (Nutting, 1904; Fraser, 1912; 1944; all as *Sertularia cornicina*). Some records from the eastern Pacific, as for instance those from California (Fraser, 1937a, as *S. cornicina*), equally mention stolonal gonothecae.

Conversely, in the populations from the eastern side of the Atlantic, the gonothecae appear to be given off mostly from the lower stem internodes, as illustrated by specimens from Mediterranean (Neppi, 1917, as *Disertasia cavolini*; Peña Cantero & García Carrascosa, 2002; present study, Fig. 5M), the Strait of Gibraltar (Medel Soteras *et al.*, 1991), Mauritania (Medel & Vervoort, 1998), and Morocco (Patriti, 1970, as *D. cornicina*).

Only in rare instances, gonothecae on both the stolon and the basal part of the stems were reported, as in material from Mediterranean (Gili i Sardà, 1986, as both *D. cornicina* and *D. cavolini*; Vervoort, 1993a), Brazil (Migotto, 1996), and Japan (Hirohito, 1995). However, none of these accounts states whether or not the gonothecae occurred simultaneously at both sites within the same or on different colonies.

A comparison of stems from Martinique (Fig. 5H) and the Mediterranean (Fig. 5M) failed to show any significant morphological difference, except perhaps for slight variations in the length of internodes and the dorsal immersion of the hydrothecae in their corresponding internodes, but these variations are far from unusual in this rather variable species.

Dynamena quadridentata (Ellis & Solander, 1786)

Fig. 5N, O

Material examined: MHNG-INVE-91112; sample #M314; France, Martinique, Le François, Pointe Jacob, 14.58552° -60.84993°, 0 m; 18.02.2014; sterile and fertile (sex undeterminable, gonothecae spent) colonies on floating *Sargassum* sp.

Description: See Millard (1975).

Distribution: Circumglobal in tropical, subtropical and temperate waters (Vervoort 1993b). The Caribbean records are summarized by Calder & Kirkendale (2005).

Remarks: For a redescription of this species, refer to Millard (1975) and Hirohito (1995).

Genus *Sertularia* Linnaeus, 1758

Sertularia distans (Lamouroux, 1816)

Fig. 6A-C

Material examined: MHNG-INVE-91120; sample #M327; France, Martinique, Le Vauclin, Pointe Faula, 14.54064° -60.82837°, 0 m; 23.02.2014; male colony on floating *Sargassum* sp.

Description: See Calder (1991).

Distribution: Circumglobal in tropical, subtropical, and temperate waters (Calder, 2013).

Remarks: For a description of this species, refer to Calder (1991) and Hirohito (1995).

Sertularia hattori Leloup, 1940

Fig. 6D, E

Sertularia hattori Leloup, 1940: 3, fig. 3. – Yamada, 1959: 71. – Okada *et al.*, 1965: 206, fig. 136. – Rho & Chang, 1972: 8, pl. 5 figs 18-20; 1974: 144. – Park & Rho, 1986: 24. – Park, 1992: 291; 1993: 269; 2010: 112, fig. 62. – Hirohito, 1995: 209, fig. 69.

Sertularia notabilis Fraser, 1947: 11, pl. 2 fig. 5. – Migotto & Vervoort, 1998: 89, figs 1-14. – Galea, 2008: 35, fig. 6J, K.

Caminothuiaria moluccana – Vannucci Mendes, 1946: 569, fig. 39 (not *Caminothujaria molukkana* Von Campenhausen, 1896).

Material examined: MHNG-INVE-91115; sample #M324; France, Martinique, La Trinité, Anse Cosmy, 14.75829° -60.96594°, 0 m; 23.02.2014; fertile colony (gonothecae spent, sex unidentifiable, stems with 1-4 pairs of hydrothecae) on floating *Sargassum* sp. – HRG-0104; France, Guadeloupe, Les Saintes, Terre-de-Haut, 15.862500° -61.59972°, 0.5 m; 25.03.2008; sterile colony on alga.

Description: For a comprehensive account, see Migotto & Vervoort (1998).

Distribution: Japan (Hirohito, 1995), Korea (Park, 2010), Brazil (Migotto & Vervoort, 1998), Caribbean Sea (present study).

Remarks: The characteristic shape of the hydrothecae and the presence of internal, submarginal cusps, allowed Galea (2008) to find sterile specimens from Guadeloupe in complete agreement with a redescription of *Sertularia notabilis* Fraser, 1947 by Migotto & Vervoort (1998), based on specimens from Brazil. The occurrence of gonothecae in the present material from Martinique, and its comparison with the former, sterile sample, confirms that both are conspecific.

Migotto & Vervoort raised the question about the relationships between Fraser's hydroid and the nominal species *S. hattori* Leloup, 1940. The former was described based on specimens from the Caribbean, while the second was based on Japanese material. Both exhibit several common features: 1) the basal stem internodes bear either an unpaired hydrotheca or subopposite (or even alternate) hydrothecae; 2) the remainder of cauli bear internodes with a rather typical shape, conferred by the proximal placement of the hydrothecal pair; 3) the thecae characteristically narrow from base to aperture, and face obliquely upwards; 4) the gonothecae are huge, deeply ringed, and curved in middle.

Despite these evidences, Migotto & Vervoort refrained from synonymizing both nominal species, on account of the absence of intrathecal cusps and the occasional presence of side branches in Asian specimens (Leloup, 1940; Hirohito, 1995).

However, it should be noted that the material inspected by Migotto & Vervoort (1998) comprised only minute stems

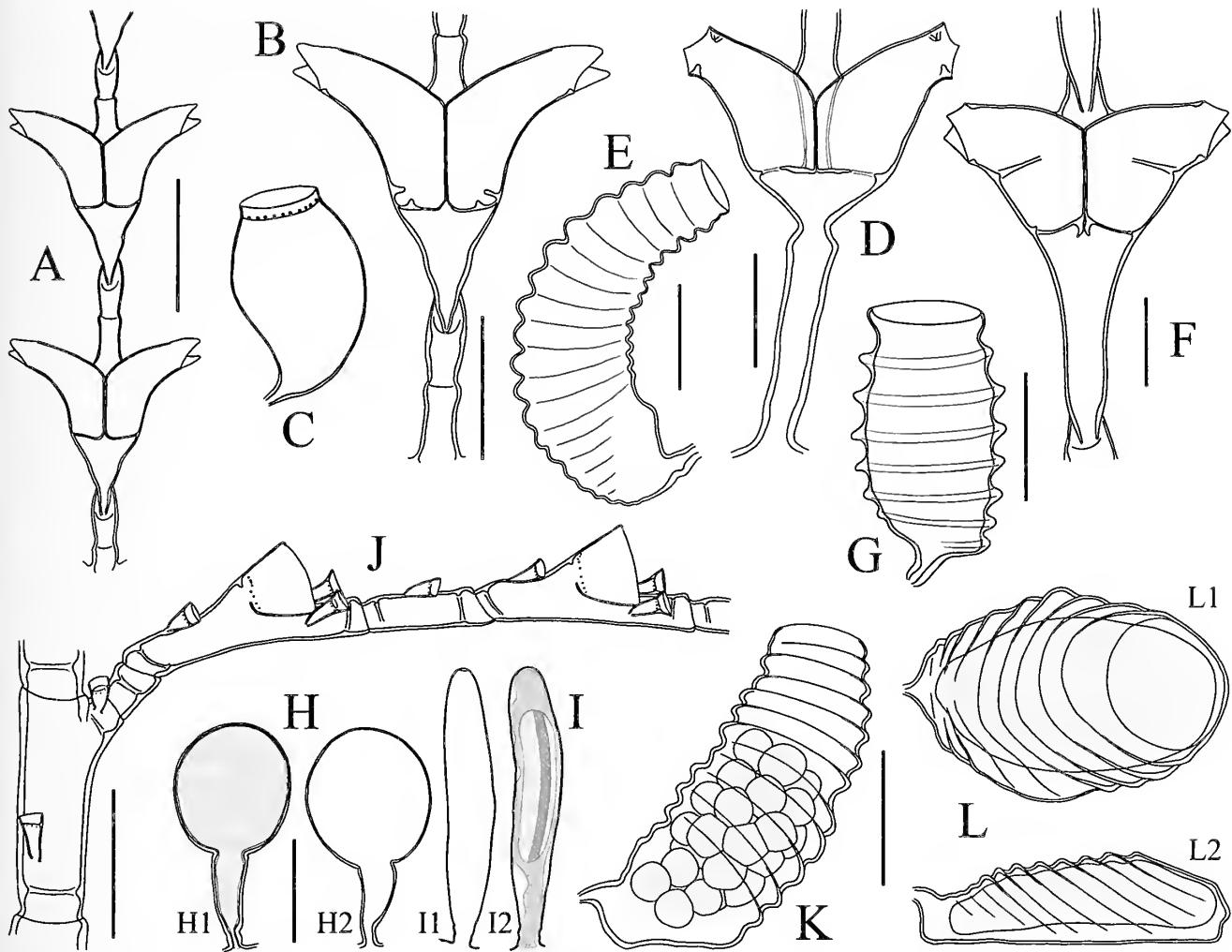


Fig. 6. A-C: *Sertularia distans* (Lamouroux, 1816). (A) Two stem internodes. (B) Detail of an internode, showing hydrothecal pair. (C) Gonotheca. D, E: *Sertularia hattori* Leloup, 1940. (D) Internode with hydrothecal pair. (E) Gonotheca. F, G: *Sertularia turbinata* (Lamouroux, 1816). (F) Internode with hydrothecal pair. (G) Gonotheca. H, I: *Hincksella pusilla* (Ritchie, 1910). (H) Two female gonothecae, one of them showing its gonophore (H¹). (I) Two male gonothecae, one of them showing its gonophore (I²). J-L: *Plumularia strictocarpa* Pictet, 1893. (J) Stem internode and basal part of a cladium. (K) female gonotheca in lateral view. (L) Male gonotheca seen from above (L¹) and laterally (L²). Scale bars: 200 µm (B, D, F, J), 300 µm (A, C), 500 (E, G-I, K, L).

bearing generally 2-5 (at most 8) pairs of hydrothecae, and it is not surprising that no lateral branches were formed in such small colonies. Conversely, Leloup had material with slightly taller stems, bearing up to 10 internodes, in which sparing, incipient side branches appeared. Even taller stems were present in the material studied by Hirohito (according to his fig. 69A, the highest stems must have had at least 13 hydrothecae), and some of them exhibited distinct side branches, although their presence was, by far, not the rule.

As for the presence or absence of intrathecal cusps, this is possibly not a species-specific feature. Indeed, such variations are well documented, not only among other members of the genus {e.g. *S. distans* (Lamouroux, 1816) [see Millard (1975)]}, but also within the family Sertulariidae {e.g. *Dynamena crisioides* Lamouroux,

1824 [see Millard (1975)]; *D. disticha* (Bosc, 1802) [see Calder (1991)]; *Symplectoscyphus unilateralis* (Lamouroux, 1824) [see Galea *et al.* (2014)]}.

In view of the arguments provided above, we believe that the occurrence of intrathecal cusps alone does not justify the specific separation of *S. notabilis* from *S. hattori*, the latter nominal species having priority.

Sertularia turbinata (Lamouroux, 1816)

Fig. 6F, G

Material examined: MHNG-INVE-91113; sample #M314; France, Martinique, Le François, Pointe Jacob, 14.58552° -60.84993°, 0 m; 18.02.2014; fertile colony (sex unidentifiable) on floating *Sargassum* sp.

Description: See Millard (1975).

Distribution: Guadeloupe and Martinique should be added to the previous Caribbean records given by Calder & Kirkendale (2005). Worldwide, the species occurs in warm waters of the Atlantic, Pacific and Indian oceans (Calder *et al.*, 2003).

Remarks: Only sterile material assigned to this species was reported earlier by one of us (Galea, 2008) from Guadeloupe. The finding of fertile material in Martinique, and comparison with the former specimens, confirms the previous identification. In spite of the numerous world records of this species [see Medel & Vervoort (1998)], its gonothecae were reported only a few times in the literature, *e.g.* Vervoort (1959), Millard (1975), Hirohito (1995).

Family Syntheciidae Marktanner-Turneretscher, 1890
Genus *Hincksella* Billard, 1918

***Hincksella pusilla* (Ritchie, 1910)**
 Fig. 6H, I

Sertularella cylindrica var. *pusilla* Ritchie, 1910: 817, pl. 77 fig. 9.

Hincksella cylindrica. – Galea, 2010a: 20, fig. 5N-P (synonymy)
 (not *Sertularella cylindrica* Bale, 1888: 765, pl. 16 fig. 7).

Material examined: HRG-0900; sample #M235; France, Martinique, Le Diamant, 14.44231° -61.03969°, 10-13 m; 20.02.2012; female colony on sponge. – HRG-0901; sample #M326; France, Martinique, Le Vauclin, Pointe Faula, 14.54064° -60.82837°, 0 m; 23.02.2014; male colony on floating *Sargassum* sp.

Description: The trophosome of this species is accurately described by Calder (1991).

Dimensions: Male gonothecae 1030-1360 µm long and 210-260 µm wide. Female gonothecae 625-675 µm long and 565-600 µm wide; pedicel 430-440 µm high.

Distribution: A comprehensive list of world records is given in Galea (2010a). *Hincksella cylindrica* sensu stricto is known exclusively from Australia (Bale, 1888; Ritchie, 1911; Pennycuik, 1959; Watson, 2002; Precker & Lawn, 2010).

Remarks: In the absence of critical comparisons with specimens of *Hincksella cylindrica* (Bale, 1888) from Australia, many accounts, including recent ones (*e.g.* Calder, 1991; Galea, 2010), have considered the widespread variety *pusilla* Ritchie, 1910 as a dwarfed form of the nominal species. Recently, we came across a paper by Precker & Lawn (2010) which includes a modern redescription and a photomicrograph of *H. cylindrica*, supplementing an earlier account by

Watson (2002). This prompted us to raise awareness of the taxonomic status of Bale's species.

Indeed, the hydrothecae of *H. cylindrica* sensu stricto are large [see Ritchie (1911); Precker & Lawn (2010)], stout, and adnate for at least half their adcauline length, while those of the "variety" *pusilla* are comparatively slender, more elongate, and adnate for only one-third to one-quarter [see measurements in Galea (2010a), p. 22, Table 2]. In our opinion, these are sufficient arguments to raise the variety *pusilla* to species, as *H. pusilla* (Ritchie, 1910).

Precker & Lawn provided the first description of the gonothecae of *H. cylindrica* sensu stricto which, in their material, arose from within the hydrothecae, with only their distalmost part becoming free from the theca. Their club shaped appearance (*ca.* 1280 µm long and 280 µm wide) suggests that they were probably male.

Although Precker & Lawn were able to note obvious morphological differences between their specimens of *H. cylindrica* and *H. cylindrica pusilla* from Moreton Bay, Queensland, they refrained from separating them specifically, on account of the absence of gonothecae in specimens of the latter. However, descriptions and/or morphometric data are available in several works, *e.g.* Torrey (1902; 1904, both as *Sertularella halecina*), Hirohito (1969; 1995), Millard & Bouillon (1975).

Similar data are also gathered from the examination of the material in hand, which comprises colonies of both sexes. The male gonothecae (Fig. 6I) arise from the stolon and are club shaped; their perisarc is very thin and easily collapsible. The female gonothecae (Fig. 6H), also arising from the stolon, are mounted on long pedicels, and are slightly ovoid to nearly spherical; their perisarc is comparatively thicker, and their lumen contains a single, large oocyte occupying the whole cavity of the theca.

Male gonothecae of the so called variety *pusilla* arising from within the hydrothecae [Torrey (1902, pl. 7 fig. 56B; 1904, fig. 14), Hirohito (1969, fig. 12B)] do not differ in shape from those of *H. cylindrica*, as described and illustrated by Precker & Lawn, and their dimensions are also similar [*e.g.* (630-1500)×(180-380) µm, according to Hirohito (1969)].

Consequently, it is realized that the male gonothecae in both species do not offer sufficient morphological criteria to allow a specific separation. The discovery of female gonothecae in *H. cylindrica* will possibly provide an additional discriminating factor but, for the time being, the characters of the hydrotheca appear sufficient enough to allow reliable identifications.

Family Plumulariidae McCrady, 1859
Genus *Plumularia* Lamarck, 1816

***Plumularia strictocarpa* Pictet, 1893**
 Fig. 6J-L

Plumularia sp. – Galea, 2008: 46, fig. 9J.

Material examined: MHNG-INVE-91106; sample #M274; France, Martinique, Anse Dufour, 14.52716° -61.09003°, 0-1 m; 12.01.2014; male and female colonies on benthic *Sargassum* sp.

Description: See Hirohito (1995) and Migotto (1996).

Distribution: Circumglobal in tropical and subtropical seas. The Caribbean records are summarized by Calder & Kirkendale (2005).

Remarks: Comparison of the present material with the infertile stems of *Plumularia* sp., described and figured by Galea (2008, p. 46, fig. 9J) from Guadeloupe, showed that both are conspecific. The male gonothecae are fully appressed to their substrate (Fig. 6L²), while only the basal part of the female is in contact with it (Fig. 6K).

Family Halopterididae Millard, 1962

Genus *Antennella* Allman, 1877

Antennella quaterna Galea, sp. nov.

Fig. 7A-G

Antennella gracilis (pro parte). – Nutting, 1900: 77 (not *A. gracilis* Allman, 1877).

Antennella quadriaurita. – Stechow, 1919: 113. – Deevey, 1954: 271. – Spracklin, 1982: 246, fig. 116I. – Lalana et al., 2001: 160. – Castellanos Iglesias et al., 2009: 98. – Henry, 2011: 69.

Antennella aff. *quadriaurita*. – Galea, 2013: 29, fig. 7K-N. not *Antennella quadriaurita*. Ritchie, 1909: 92, fig. 9. not *Antennella quadriaurita*. – Calder, 1997: (=? *Monostaechas* sp.).

Holotype material: MHNG-INVE-91103; sample #M076; France, Martinique, Case-Pilote, 14.63753° -61.13974°, 9-15 m; 27.01.2012; fertile (female) colony on stem of *Thyroscyphus marginatus* (Allman, 1877).

Paratype material: MHNG-INVE-91104; sample #M076; France, Martinique, Case-Pilote, 14.63753° -61.13974°, 9-15 m; 27.01.2012; sterile colonies on three stems of *T. marginatus*.

Additional material: MHNG-INVE-91125; part of sample H5 GS08; United Kingdom, Gough Island, -40.34485° -9.87765°, 10-17 m; 29.01.2014; part of a male colony with stems up to 5 em high growing on cluster of serpulid tubes. – MHNG-INVE-91126; part of sample #BAS JR287 DB 12-0293; United Kingdom, offshore station between Inaccessible and Nightingale islands, -37.31° -12.49°, 200 m; 23.05.2013; up to 5.5 cm high stems on gorgonian axis, some bearing either female or both male and female gonothecae. – MHNG-INVE-91127; part of sample #BAS JR287 DB 12-0420; United Kingdom, off the eastern coast of Tristan da Cunha, -37.12° -12.21°, 90 m; 25.05.2013; up to 3.5 cm high stems on octocoral, some bearing

female gonothecae. – BAS JR287 DB 12-0073; United Kingdom, off the northern coast of Gough Island, -40.26° -9.93°, 120 m; 20.05.2013; female colony with 7-8 em high stems, on shell gravel; – BAS JR287 DB 12-0260; United Kingdom, offshore station between Inaccessible and Nightingale islands, -37.34° -12.5°, 180 m; 23.05.2013; female colony composed of up to 6 cm high stems, on dead gorgonian.

Diagnosis: *Antennella* with heteromerous segmentation of stem; hydrothecate internodes short, carrying a hydrotheca, a mesial nematotheca, as well as two pairs of laterals; ahydrothecate internodes comparatively longer, with 3-4 frontal nematothecae in 2 parallel, closely-set rows. Gonothecae typical of the genus. Cnidome comprising a seed-shaped heteroneme, a microbasic mastigophore, and a large, ovoid heteroneme.

Etymology: From the Latin *quaterni, ae, a*, meaning constantly four, with reference to the presence of a double pair of lateral nematothecae flanking each hydrotheca.

Description: Colonies comprising short, upright shoots arising from creeping hydrorhiza. Basal part of stems of varied length, composed of 1-3 internodes delimited by transverse constrictions of the perisarc, distalmost node oblique; a varied number of frontal nematothecae in two parallel, closely-set rows. Remainder of stem heteromerously segmented by alternating oblique and transverse nodes, the latter slightly marked. Hydrothecate internodes, up to 6 per stem, with proximal oblique and distal transverse nodes; short, so as to accommodate a hydrotheca placed in middle, and its 5 associated nematothecae: a mesial one, far below the hydrothecal base, and two pairs of laterals. External pair borne on well-developed apophyses; trumpet-shaped, basal chamber high, upper chamber shallow, rim sinuous adaxially. Internal pair sessile, rim of upper chamber even. Hydrotheca cup-shaped, axis oblique to that of internode; perisarc thin; adcauline wall adnate for 2/3rd its length; free part and abcauline wall parallel; margin circular, rim even. Ahydrothecate internodes comparatively longer than their hydrothecate counterparts; proximal node transverse, distal node oblique; 3-4 frontal nematothecae in two parallel, closely-set rows. Gonothecae, female in present material, pear shaped, given off singly from below a hydrotheca through a short apophysis, followed by a quadrangular segment; basal part tapering abruptly, provided with two bithalamic nematothecae; aperture distal, rounded, closed by watch glass-shaped lid. Nematocysts: seed-shaped heteronemes, microbasic mastigophores, as well as large, ovoid heteronemes with shaft spanning about half the length of the capsule.

Dimensions: Stems up to 5 mm high. Thecate internodes 270-310 µm long, athenate internodes 340-

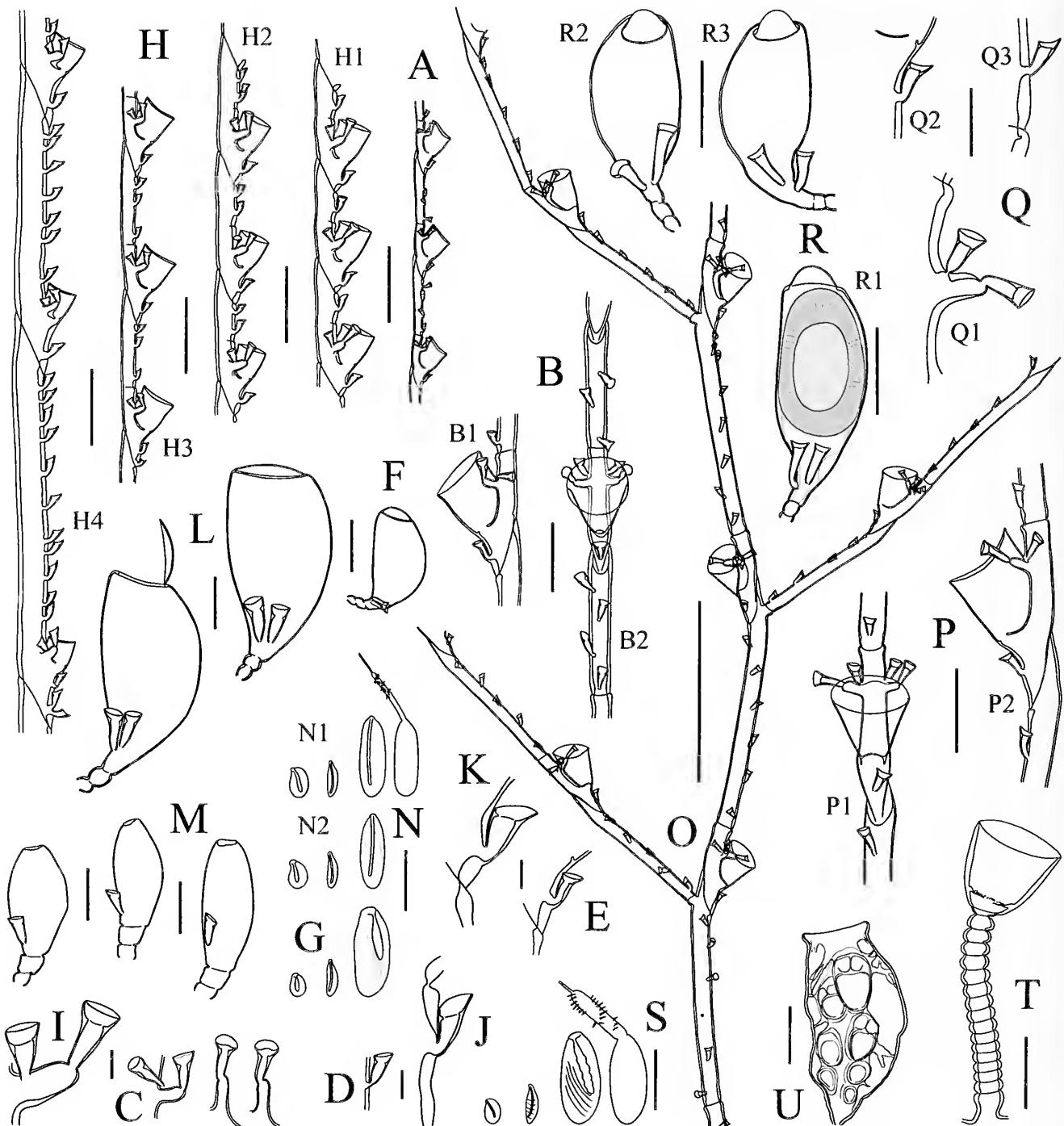


Fig. 7. A-G: *Antennella quaterna* sp. nov. (A) Fragment of stem compared with its homologues from *A. quadriaurita* Ritchie, 1909 [samples H5-GS08 ($H^1\text{-}2$), DB 12-0260 (H^3), and DB 12-0073 (H^4)]. (B) Hydrothecate segment in lateral (B^1) and frontal (B^2) views. (C-E) Lateral (C), caulinar (D), and mesial (E) nematothecae compared with their homologues from *A. quadriaurita* (I, J, and K, respectively). (F) Female gonotheca compared with two female (L, both from sample DB 12-0260) and three male (M, all from sample H5-GS08) gonothecae of *A. quadriaurita*. (G) Cnidome compared to that of two samples of *A. quadriaurita* [H5-GS08 (N^1) and DB 12-0420 (N^2)]. O-S: *Monostaechas bertoti* sp. nov. (O) Fragment of cormoid, showing the heteromerous segmentation of both caulus and cladia. (P) Hydrothecate internode in frontal (P^1) and lateral (P^2) views. (Q) Nematothecae: pair of laterals (Q^1), mesial (Q^2), and from caulinine ahydrothecate internode (Q^3). (R) Three gonothecae, one of which containing a female gonophore (R'). (S) Cnidome. T, U: *Clytia edentula* Gibbons & Ryland, 1989. (T) Hydrotheca atop its pedicel. (U) Gonotheca carrying medusa buds. Scale bars: 10 μm (G, N, S), 50 μm (C-E, I-K), 100 μm (Q), 200 μm (B, F, L, M, P, R), 300 μm (T, U), 500 μm (A, H), 1 mm (O).

560 µm long and 45-60 µm wide at node. Abcauline wall of hydrotheca 130-175 µm long, free part of adcauline wall 90-95 µm, adnate part 140-160 µm; diameter at rim 175-185 µm. Gonotheca 400-415 µm long and ca. 200 µm wide; aperture ca. 100 µm wide; pedicel 30-40 µm long. Seed-shaped heteronemes ca. 4.2×2.6 µm; microbasic mastigophores ca. 6.4×2.2 µm; large, ovoid heteronemes 14.08-16.05 µm long (14.83 ± 0.54 µm, n=20) and 5.63-6.61 µm wide (5.99 ± 0.28 µm, n=20).

Distribution: Cuba (Stechow, 1919), Gulf of Mexico (Deevey, 1954), Belize (Spracklin, 1982; Henry, 2011), Cuba (Lalana *et al.*, 2001; Castellanos Iglesias *et al.*, 2009), and Martinique (present study).

Type locality: France, Martinique, Case-Pilote.

Remarks: Stechow (1919), who reexamined Nutting's (1900) Cuban material assigned to *A. gracilis* Allman, 1877, noted that two pairs of lateral nematothecae flanked each hydrotheca ("überall zwei Nematophoren nebeneinander saßen"). He found that material in perfect agreement with *A. quadriaurita* Ritchie, 1909, and identified it as so. There is neither a description nor figures for the Cuban material but, owing its geographical distribution, it is thought to belong to *A. quaterna* sp. nov.

In a recent paper, one of us (Galea, 2013) assigned, with a query, the present material to Ritchie's species, pending a wider study based on specimens from the type locality (Gough Island), as well as from various locations around the world, in order to clarify the taxonomic status of those records. A first comparison with a specimen of *A. quadriaurita* from Inaccessible Island (see Galea, 2010b) made it possible to point out differences in the size of hydro- and nematothecae, as well as a dissimilar cnidome composition (Galea, 2013).

By a fortuitous coincidence, one of us (HRG) was entrusted for identification with several hydroid samples from both shallow- and deep-water stations around the Tristan da Cunha group of islands, among which several contain fertile specimens of *A. quadriaurita*. As noted by Ritchie (1909), the stems of his species grow in dense tufts from a reduced base, being characteristically "hairlike and stand out rigidly from a creeping stolon like a group of stiff bristles". Their height may reach as much as 7-8 cm high.

Microscopically, their internodes, hydrothecae, and gonothecae are comparatively of larger proportions than those of *A. quaterna*. The colonies from littoral stations (e.g. H5 GS08) have short (210-395 µm) ahydrothecate internodes carrying one or two nematothecae (Fig. 7H¹,²), while those from deep-water localities (e.g. DB 12-0260) possess longer (320-890 µm) internodes, bearing 3-4 nematothecae in two parallel, closely-set rows (Fig. 7H³). An extreme situation is met with in sample DB 12-0073, in which several consecutive basal ahydrothecate

internodes are exceedingly long (up to 1690 µm) and carry up to 12 nematothecae (Fig. 7H⁴).

The hydrothecae are large, with an abcauline wall 220-275 µm long, a free adcauline wall 90-120 µm long, an adnate part 170-220 µm long, and an aperture 200-270 µm wide (pooled data from measurements taken from several samples). The female gonothecae (Fig. 7L) are borne on short (75-90 µm), quadrangular pedicels, and are 725-780 µm long and 350-460 µm wide, with a 200-250 µm wide aperture. The male gonothecae (Fig. 7M) are also borne on short pedicels (75-90 µm), and are 390-515 µm long and 170-235 µm wide; they carry generally a single nematotheca basally, but either none or up to two may occur in rare instances.

Besides the seed-shaped microbasic heteronemes and the banana-shaped microbasic mastigophores, also common to *A. quaterna*, the cnidome of *A. quadriaurita* comprises a large, ovoid heteroneme, 11.26-13.94 µm long (12.74 ± 0.75 µm, n=20) and 3.66-4.36 µm wide (4.01 ± 0.24 µm, n=20), with a long, diagonal shaft spanning the whole length of the capsule. These capsules are more tubular and comparatively smaller than those of the new species (compare Fig. 7G and 7N), and their shaft is almost as long as the capsule itself.

Taken together, the features listed above show that *A. quadriaurita* is a species of larger proportions and has a cnidome that is different from that of the Martinican hydroid, thus justifying their specific separation. In addition, it appears that – besides their general resemblance – both species could confidently be separated only using morphometric data and through the study of their cnidomes. It becomes therefore obvious that the actual geographical distribution of *A. quadriaurita* could not be evaluated properly, with the exception of the West and South African records, but perhaps not of those from India, Korea, Japan or New Zealand [a list of world records is summarized by Vervoort & Watson (2003)]. For the time being, only the records from the Caribbean and the Gulf of Mexico that were assigned earlier to Ritchie's species are kept in *A. quaterna*.

The Brazilian material assigned to *A. quadriaurita* by Grohmann *et al.* (2003) has stems reaching up to 4.8 cm high and its cnidome contains the same heteronemes as the specimens from Tristan da Cunha area (P. Grohmann, *pers. comm.*). In addition, the dimension of its hydrothecae, calculated from their fig. 2, corresponds to the present concept of Ritchie's species.

Genus *Monostaechas* Allman, 1877

Monostaechas bertoti Galea & Ferry, sp. nov.
Fig. 7O-S

Holotype material: MHNG-INVE-91122; sample #M334; France, Martinique, Case-Pilote, Fond Boucher, 14.65536° - 61.15657° , 12-14 m; 24.06.2014; fertile

colony on alga, some stems with female gonothecae, mostly immature, though some ripe are also present.

Paratype material: MHNG-INVE-91123; sample #M334; France, Martinique, Case-Pilote, Fond Boucher, 14.65536° -61.15657° 12-14 m; 24.06.2014; colonies on three fragments of algae, some stems with female gonothecae, as above.

Diagnosis: *Monostaechas* with monosiphonic stems, giving off laterally to irregular or alternately-placed cladia; segmentation heteromerous on both stem and cladia; hydrothecae with two pairs of lateral nematothecae; cauline intersegments with 4-8 nematothecae in two closely-set rows; cladal intersegments with 4-6 nematothecae in one row; gonothecae ovoid, with two long, basal nematothecae and a dome-shaped lid.

Etymology: This new species is named in honor of our friend Jean-Marie Bertot, a marine fauna enthusiast who explored the reefs of Martinique for almost two decades. He accompanied us during numerous dives and participated to the collecting effort.

Description: Colony arising from creeping, branching hydrorhiza, apparently devoid of nematothecae. Stems simple, monosiphonic, slender, straight to slightly geniculate (Fig. 7O). Shortly above the origin from stolon, a transverse node indicates the beginning of the stem; occasionally, a basal part, composed of one or two rectangular segments of varied length and carrying up to two nematothecae, is present; otherwise, stem divided heteromerously by alternation of straight and oblique nodes. Ahydrothecate segments long and slender, delimited proximally by transverse node and distally by oblique node; distally, a short, lateral apophysis supporting a cladium; generally 5-6 (rarely 4, and up to 8, or even 12 in the basalmost segment) nematothecae in two closely-set, parallel rows. Hydrothecate internodes up to 13 per stem; basally an oblique node, distally a transverse one; short, so as to accommodate a hydrotheca in middle and 5 nematothecae: a mesial one, far below the base of hydrotheca, as well as two pairs of laterals flanking the theca; external pair borne on tall apophyses; internal pair inserted on both sides of the axil made by the adaxial wall of the theca with the internode behind. Cladia, up to 7 per cormoid, widely spaced, given off laterally either alternately or irregularly left and/or right; structure similar to stem, except for the presence of only 4-5 (rarely 6) nematothecae in one row on each ahydrothecate internode; up to 11 hydrothecate internodes per cladium; some cladia branched once through a lateral apophysis given off from the distal part of an ahydrothecate segment. Hydrothecae from stem and cladia alike; moderately deep, tubular, adnate for two thirds their adaxial length, walls parallel, margin slightly scooped in lateral view, rim even, not everted (Fig. 7P²). All

nematothecae bithalamic and movable (Fig. 7Q); basal chamber comparatively taller than upper one; aperture with even rim. Gonothecae borne on stems and cladia, given off through short, lateral apophyses below a hydrotheca; basally a short, rectangular segment; overall shape of gonotheca ovoid, basally curved and tapering, distally truncate and bearing a large, rounded aperture; the latter closed by a dome-shaped lid. All gonothecae presumably female. Nematocysts (Fig. 7S): three size classes of microbasic mastigophores (seed-shaped, banana-shaped, as well as large and ovoid capsules).

Dimensions: Stems up to 2 em high, apophyses for cladia 30-45 µm long. Width of caulus 50-90 µm, and of cladia 40-50 µm (both at nodes). Length of hydrothecate segments 320-400 µm (cauline) / 320-370 µm (cladial). Length of ahydrothecate segments 735-1155 µm (cauline) / 615-775 µm (cladial). First cladal segment 650-920 µm long. Free adaxial wall of hydrotheca 80-90 µm, adnate part 155-170 µm, abcauline wall 180-200 µm long, aperture 175-190 µm wide. Gonotheca 415-510 µm long, 210-225 µm wide in middle and 85-110 µm at aperture; apophysis 25-30 µm long; small, rectangular segment 35-50 µm long. Caulinar, cladal, and mesial nematothecae 65-75 µm long and 30-40 µm wide at rim. External pair of lateral nematothecae 60-90 µm long, 35-40 µm wide at aperture; apophyses 50-60 µm long. Inner pair of lateral nematothecae 50-65 µm long, 25-30 µm wide at rim. Gonothecal nematothecae 90-140 µm long, 45-50 µm wide at rim. Nematocysts: seed-shaped capsules (4.0-4.3)× ca. 2.4 µm, banana-shaped capsules (6.4-6.7)×(2.1-2.3) µm, large capsules (14.2-15.6)×(5.9-6.2) µm.

Distribution: Known only from Martinique (present study).

Type locality: Franee, Martinique, Case-Pilote, Fond Boucher.

Remarks: Three members of the genus possess two pairs of lateral nematothecae flanking the hydrothecae, *viz.* *M. faurei* Millard, 1958, *M. natalensis* Millard, 1958, and *M. providentiae* (Jarvis, 1922). The two former build colonies with thick, polysiphonic stems, whose complex structure was described in detail by Millard (1958). Only *M. providentiae* comes close enough to the present species, but it exhibits the following distinguishing features: 1) its stems and cladia are divided homomerously instead of heteromerously; 2) there are only 2-3 nematothecae per internode, rather than commonly 5-6 (but up to 8 possible) on the cauline internodes, and 4-5 (occasionally 6) on the cladal ones of *M. bertoti*; 3) the cladia are reportedly given off from one side of the stem (Jarvis, 1922), rather than more or less regularly alternate, as in the new species.

Family Campanulariidae Johnston, 1836
Genus *Clytia* Lamouroux, 1812

***Clytia edentula* Gibbons & Ryland, 1989**
 Fig. 7T, U

Clytia edentula Gibbons & Ryland, 1989: 398, fig. 17.

Material examined: MHNG-INVE-91107; sample #M276; France, Martinique, Anse Dufour, 14.52716° -61.09003°, 0-1 m; 12.01.2014; fertile colonies on fragments of benthic *Sargassum* sp.

Description: See the original account by Gibbons & Ryland (1989).

Dimensions: Pedicel 840-3290 µm high, 70-115 µm wide. Hydrotheca 355-420 µm high, 310-445 µm wide at aperture. Gonotheca ca. 1000 µm high, 525 µm in maximum diameter, and 355 µm wide at aperture.

Distribution: Previously known only from Fiji (Gibbons & Ryland, 1989); this is the first record from the Caribbean.

Remarks: These hydrothecae with even rim, mounted on almost ringed pedicels, leave little doubt about the identity of this hydroid. As already underlined by Gibbons & Ryland (1989), *Cytia hummelincki* (Leloup, 1935) has comparatively shallower and wider hydrothecae, a subhydrothecal spherule is present, and the gonothecae are devoid of a collar. These features are also evident from the account of Galea (2008), and are further supported by the co-occurrence in the present collection of fertile colonies of *C. hummelincki*.

Gibbons & Ryland assumed that the wide gonothecal aperture is evidence that the gonophores are free swimming medusa. Their hypothesis is actually confirmed upon examination of the present material, in which several medusa buds can be observed within the gonotheca.

It is worthwhile noting that the nominal species *C. hummelincki* is, very likely, nothing more than a junior synonym of *Campanularia brevithecata* Thornely, 1900. Colonies of the latter form simple, unbranched stems, annulated basally and occasionally elsewhere, and are provided distally with a characteristic spherule below a very shallow hydrotheca. All these are features met with in Leloup's species. In addition, nothing distinguishes the shape of the gonotheca illustrated by Thornely from those examined by Millard (1975) in her material from the Indian Ocean assigned to *C. hummelincki*. Moreover, the presence in each gonotheca of *C. brevithecata* of one or two gonophores with four radial canals (there is no mention of discernible gonads), is in conformity with several convergent observations on *C. hummelincki* (Millard, 1975; Gravili *et al.*, 2008; present study). It is obvious that the occurrence of a subhydrothecal spherule and the lack of knowledge of the nature of the gonophores mislead Thornely with respect to the genus in which she included her new species.

***Clytia laxa* Fraser, 1937b**

Clytia laxa Fraser, 1937b: 1, pl. 1 fig. 1. – Spracklin, 1982: 246, fig. 115B.

Laomedea tottoni – ? Wedler, 1973: 34, fig. 4.

Clytia tottoni. – Galea, 2010a: 7, fig. 2C-H.

not *L. tottoni* Leloup, 1935: 26, figs 11, 12 = replacement name for *Clytia fragilis* Congdon, 1907: 470, fig. 13 = *Clytia linearis* (Thornely, 1900).

not *Laomedea (Phialidium) tottoni*. – Vervoort, 1968: 17, fig. 6 [= *Clytia linearis* (Thornely, 1900)].

not *Laomedea tottoni*. – Leloup, 1974: 21, fig. 17 (= *Clytia* sp.). not *Obelia tottoni*. – Park, 1998: 60, fig. 1 (= *Clytia* sp.).

Clytia arborescens. – Billard, 1906: 167. – Medel & Vervoort, 2000: 30, figs 7-8 (not *Clytia arborescens* Pictet, 1893: 33, pl. 2 figs 28, 29).

Description: For the latest description of this species, see Galea (2010a).

Distribution: Reliable records are from the Dry Tortugas (Leloup, 1935, as *Clytia tottoni*), Puerto Rico (Fraser, 1937b), Guadeloupe (Galea, 2010a, as *C. tottoni*), Martinique (Galea, unpublished data), and Madeira [Billard, 1906; Medel & Vervoort, 2000; both as *C. arborescens* (Pictet, 1893)].

Remarks: Leloup (1935) proposed the replacement name *Laomedea tottoni* for *Clytia fragilis* Congdon, 1907 to avoid secondary homonymy with *Obelia fragilis* Calkins, 1899 when both are placed in the genus *Laomedea* Lamouroux, 1812. According to Calder (1991), *C. fragilis* is coterminous with *Clytia linearis* (Thornely, 1900), and *L. tottoni* therefore automatically becomes a synonym of Thornely's species as well. In being a replacement name for *C. fragilis*, *L. tottoni* has the same type as that of Congdon's species (ICZN Art. 72.7), and the two binomina are objective synonyms. However, Caribbean material described by Leloup under the name *L. tottoni* differs morphologically from *C. linearis* [see descriptions given by both Leloup (1935) and Galea (2010a)], conforming instead with *Clytia laxa* Fraser, 1937b.

The material from Madeira assigned by Medel & Vervoort (2000) to *C. arborescens* (Pictet, 1893) is a misidentification of *C. laxa*. Indeed, Schuchert (2003), who examined not only the type of Pictet's hydroid, but also additional material from the Kei Islands, noted that the hydrothecal cusps in this species are sinusoid and symmetric, thus differing from the triangular ones, inclined to one side, present in the material examined by Medel & Vervoort. An earlier record, equally attributed to *C. arborescens*, from the same area (Billard, 1906), most probably belongs to the present hydroid as well. Due to their geographical remoteness, the Chilean (Leloup, 1974) and Korean (Park, 1998) records assigned to *C. tottoni* are thought to belong to different taxa.

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Systematics of the genus *Hormiops* Fage, 1933 (Hormuridae, Scorpiones)

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Abstract: Based on a recently published phylogeny of Australasian hormurid scorpions, *Hormiops* Fage, 1933, previously considered a doubtful taxon by some authors, is now reinstated as a valid genus. These lithophilous scorpions are currently only recorded from two groups of granitic islands in the South China Sea, the Côn Đảo Archipelago near the southern tip of Vietnam and the Seribuat Archipelago off the south-east coast of Peninsular Malaysia. Each of these archipelagos is harbouring a distinct species. Newly collected specimens enable the examination of unknown or inadequately studied morphological characters, such as cuticle ornamentation, hemispermatophores and book lungs. Based on these new data, updated descriptions with high resolution illustrations of important diagnostic characters are provided for *H. davidovi* Fage, 1933 and *H. infulcra* Monod, 2014.

Keywords: *Hormiops davidovi* - *H. infulcra* - taxonomy - South China Sea - Vietnam - Malaysia - lithophilous.

INTRODUCTION

The validity of the hormurid genus *Hormiops*, described from the Vietnamese Côn Sơn Island, formerly known as Poulo Condore and part of the Côn Đảo Archipelago, was confirmed only recently (Monod & Prendini, 2015). *Hormiops* Fage, 1933 was previously considered as a junior synonym of *Liocheles* Sundevall, 1833 by Lourenço (1989), Fet (2000) and Prendini (2000). Fet (2000) placed *Hormiops davidovi* Fage, 1933 in the synonymy of *Liocheles australasiae* (Fabricius, 1775), whereas Prendini (2000) recognized it as a valid species within *Liocheles*. Lourenço & Monod (1999) reinstated the genus, but their decision was not accepted by Prendini (2000) who deemed the diagnostic characters insufficient for a generic distinction. Monod & Prendini (2015) confirmed the validity of the genus *Hormiops* based on a proper phylogenetic framework. A second species, *H. infulcra*, discovered on granitic islands off southern Peninsular Malaysia was subsequently added to the genus (Monod, 2014). Two species of *Hormiops* are thus currently recognized: *Hormiops davidovi* from the Côn Đảo Archipelago near the southern tip of Vietnam, and *H. infulcra* from the Seribuat Archipelago off the south-eastern coast of Peninsular Malaysia. Field surveys were recently conducted in both archipelagos and these yielded sufficiently large series of specimens. Thus far the limited material available and the poor state of preservation of *H. davidovi* types (faded colouration and loss of cuticle fluorescence) had prevented a complete and accurate study of characters such as cuticle

ornamentation, hemispermatophores and book lungs. The newly collected material enabled the examination of these characters, which were previously unknown or inadequately studied, and allowed updated descriptions with high quality illustrations of important diagnostic characters for both species.

The present contribution was originally part of a manuscript on the systematics and biogeography of the genus *Hormiops*. The taxonomic section was greatly reduced at the editor's request in order to fit the standard of the journal, and thus a shorter manuscript, which only includes diagnoses and illustrations of the most important characters for both *Hormiops* species, was published (Monod, 2014). The extensive descriptions and illustrations that could not be incorporated in this first paper are presented here.

MATERIAL AND METHODS

Fieldwork: Scorpions were collected during the day by inspecting rock crevices and exfoliations, and at night with ultraviolet (UV) light (Stahnke, 1972) using a portable Maglite lamp equipped with a UV led retrofit (Xenopus electronix, Austin, TX, U.S.A.).

Georeferencing: Exact geographical coordinates of collecting localities were recorded using a portable GPS device (Garmin E-trek Summit). Only coarse data, rounded to the nearest 10 seconds, are provided in the present publication following the recommendations of

Chapman & Grafton (2008). Geographical coordinates for records without GPS data were traced by reference to gazetteers and the Geonet Names server (<http://earth-info.nga.mil/gns/html/index.html>) and are given between brackets.

Abbreviations: Depositories containing material examined in the present study are abbreviated as follows: LKCM, Lee Kong Chian Natural History Museum, National University of Singapore (Singapore), MHNG, Muséum d'histoire naturelle (Geneva, Switzerland); MNHN, Muséum National d'Histoire Naturelle (Paris, France). Other abbreviations: NP, National park.

Examination and dissection: Specimens were examined with a Zeiss Stemi SV8 stereomicroscope. Hemispermatophores were dissected from adult male specimens using microsurgical scissors and forceps immediately after the animals were euthanized. Paraxial organ tissue was then removed manually with forceps. Dissecting the specimens as early as possible ensure that paraxial organ tissue has not stiffened yet and can be removed more easily without damaging the hemispermatophores. This is particularly recommended for small, weakly sclerotized hemispermatophores like those of *Hormiops*.

Morphological terminology and mensuration: Morphological terminology follows Vachon (1956, 1963) for cheliceral dentition, Stahnke (1970) for pedipalp segmentation, Vachon (1974) for trichobothrial patterns, Couzijn (1976) for leg segmentation, Lamoral (1979) and Monod & Volschenk (2004) for hemispermatophore, Kamenz *et al.* (2005) and Kamenz & Prendini (2008) for book lungs, and Prendini (2000) for carapace sulci and sutures, and pedipalp and metasomal carinae. Measurements follow Stahnke (1970) and were recorded in mm using an ocular micrometer or digital calipers.

Photographs and illustrations: High resolution fluorescence images of diagnostic characters were taken under long-wave UV (Volschenk, 2002, 2005) and visible light with a custom-built stacking system at the MHNG. Zerene Stacker (Zerene Systems, Richland, WA, U.S.A.) was used to fuse images taken at different focal planes into a single image with greater depth of field. Line drawings of hemispermatophores were produced using a camera lucida mounted on the stereomicroscope. Pencil sketches were subsequently inked and scanned for further processing and editing. Illustrations and photographs were edited (background removal and contrast adjustment) in Adobe Photoshop CS5, and plates prepared with Adobe Illustrator CS5 (both from Adobe systems, San Jose, CA, U.S.A.). Colour drawings were produced as digital media based on scientific illustrations and photographs of live specimens to accurately illustrate the colours present in life.

Scanning electron microscopy (SEM): SEM was used to explore the fine structures of post-insemination spermatophores and book-lungs. Spermatophores were obtained by placing male and female scorpions in a terrarium. When mating occurred, spermatophores were retrieved from the enclosures and placed in 75% ethanol immediately after copulation. They were then dehydrated in a graded alcohol series, critical point dried in a SPI-DRY critical point dryer (SPI supplies, West Chester, PA, U.S.A.), mounted on standard aluminium stubs (diameter 12.5 mm, height 6 mm; Agar Scientific, Essex, U.K.), and finally sputter-coated with gold in a Cressington Sputtercoater 108 Auto. Half of one sternite was dissected from specimens preserved in 100% ethanol. Sternites and book lungs were sliced transversally at the spiracle level, leaving an anterior part bearing the lungs per se and a posterior part bearing the atrial wall and posterior spiracle edge. Alcohol was removed from these two parts by critical point drying. The anterior part was then sliced sagitally to expose lamella surfaces. The dissected structures were then mounted on common stubs and sputter-coated with gold. Samples were examined with a Zeiss DSM940A SEM.

Mapping: Distribution maps were produced using ArcGIS version 9.3 (Environmental Systems Research Institute, Redlands, CA, U.S.A.) by superimposing locality record coordinates on a SRTM 90 m (3 arc-second) digital elevation model (Jarvis *et al.*, 2008) and on a SRTM 1 km (30 arc-second) global bathymetry dataset (Becker *et al.*, 2009).

Allometry: The pronounced sexual dimorphism of pedipalps observed in the two *Hormiops* species was analysed by comparing allometric slopes of a standardized major axis (SMA; Kermack & Haldane, 1950) of males and females. The degree of allometry is traditionally measured by the equation $Y = aX^\alpha$, where X is the measurement of a basic, independent character such as body length, Y the measurement of a dependent character such as pedipalp size whose allometric index α is to be determined, and a is a normalization constant also known as the 'Y intercept' or elevation of the slope. The actual computation usually proceeds through a regression analysis using the linear analogue of the allometric equation ($\log Y = \alpha \log X + \log a$). SMA analyses were used to determine the lines-of-best-fit for each bivariate group. SMA regression is methodologically more appropriate to assess allometric relationships between two variables than ordinary least-square (OLS) regression (Ricker, 1984; Green, 1992; Warton *et al.*, 2006; Bonduriansky, 2007; Claude, 2008). OLS regression estimates the line of best fit by minimizing the sum of squares of residuals measured in the Y direction. It basically attributes all residual variation to Y , which translates into an underestimation of the allometric slope. On the other hand, SMA

regression assumes equal error in both measurements, X and Y, and thus provides a more accurate estimate of the axis.

Length of pedipalp chela, patella, femur and of carapace of mature specimens of *H. davidovi* (11 males and 22 females) and *H. infulcra* (25 males and 25 females) were measured. Pedipalp length was calculated by adding up chela, patella and femur lengths, and the carapace was used as a measure of overall body length. Analyses of allometric relationships between pedipalp and body sizes were implemented with the "SMATR" module version 3.2.3 (Warton *et al.*, 2011; Warton *et al.*, 2012) for the R statistical package version 2.12.2 (R Development core Team, 2011). Bivariate scatter plots of the pedipalp size (Y) versus body size (X) with fitted SMA slopes for males and females were computed for each species. Each slope was tested for allometry using the *slope.test* command that estimates whether the residual axis and fitted axis scores are uncorrelated under a hypothetical allometric slope α (Warton *et al.*, 2006). Here, the α value was set at 1.0 in order to assess significant deviation from isometry (H_0). Intersexual differences in allometric slope were then estimated for each species using the likelihood

ratio test proposed by Flury (1984) and Warton & Weber (2002). Significance levels for all tests were set at $P=0.05$.

SYSTEMATICS

Family Hormuridae Laurie, 1896

Genus *Hormiops* Fage, 1933

Hormiops davidovi Fage, 1933

Figs 1A-C, 2-12, 13A, 14, 15, Tab. 1

Hormiops davidovi Fage, 1933: 32-33, figs 1, 2, pl. I, figs a-c.

— Fage, 1936: 181. — Kästner, 1941: 234, fig. 215. — Takashima, 1945: 94, 95. — Fage, 1946: 71. — Vachon, 1974: fig. 80. — Kovářík, 1998: 132. — Lourenço & Monod, 1999: 343-344, figs 1-4. — Lourenço, 2011: 774. — Monod, 2014: 601-602, figs 1a, c, 2a, 3a-b, d, f-g.

Hormiops davydovi. — Monod & Prendini, 2015: 5-16, 24-25, 34, fig. 1A.[misspelling].

Liocheles australasiae. — Fet, 2000: 395.

Liocheles davidovi. — Prendini, 2000: 72. — Monod & Volschenk, 2004: 686.

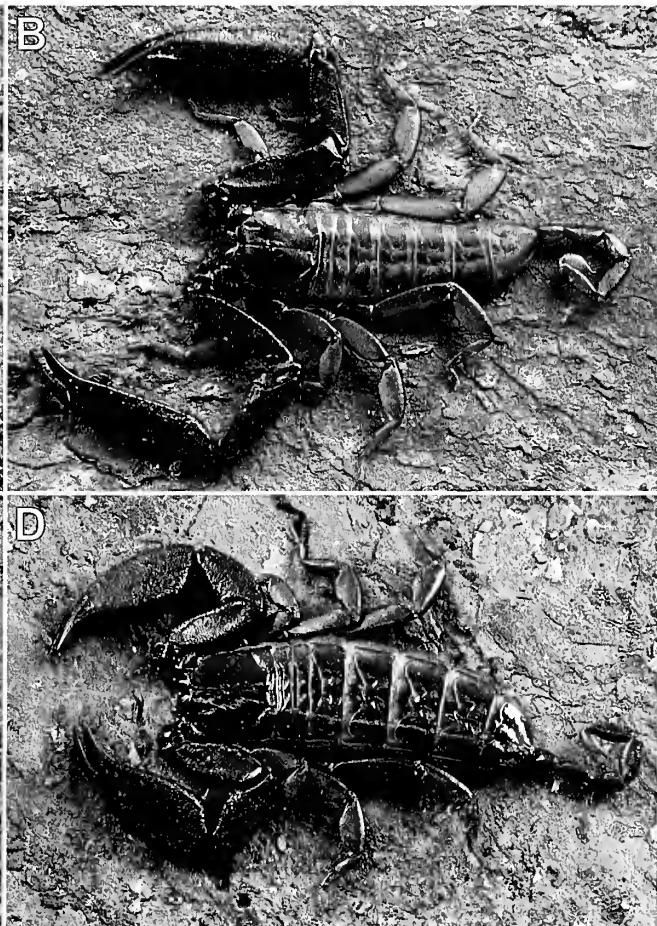
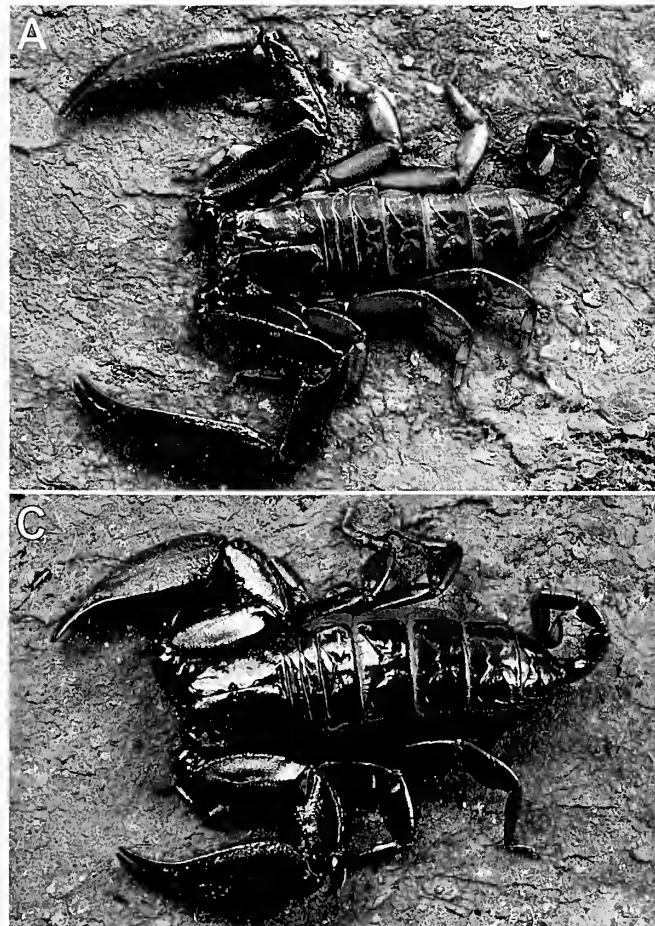


Fig. 1. Live specimens of the species in the hormurid genus *Hormiops* Fage, 1933. (A, C) *Hormiops davidovi* Fage, 1933, male (A) and female (C). (B, D) *Hormiops infulcra* Monod, 2014, male (B) and female (D).

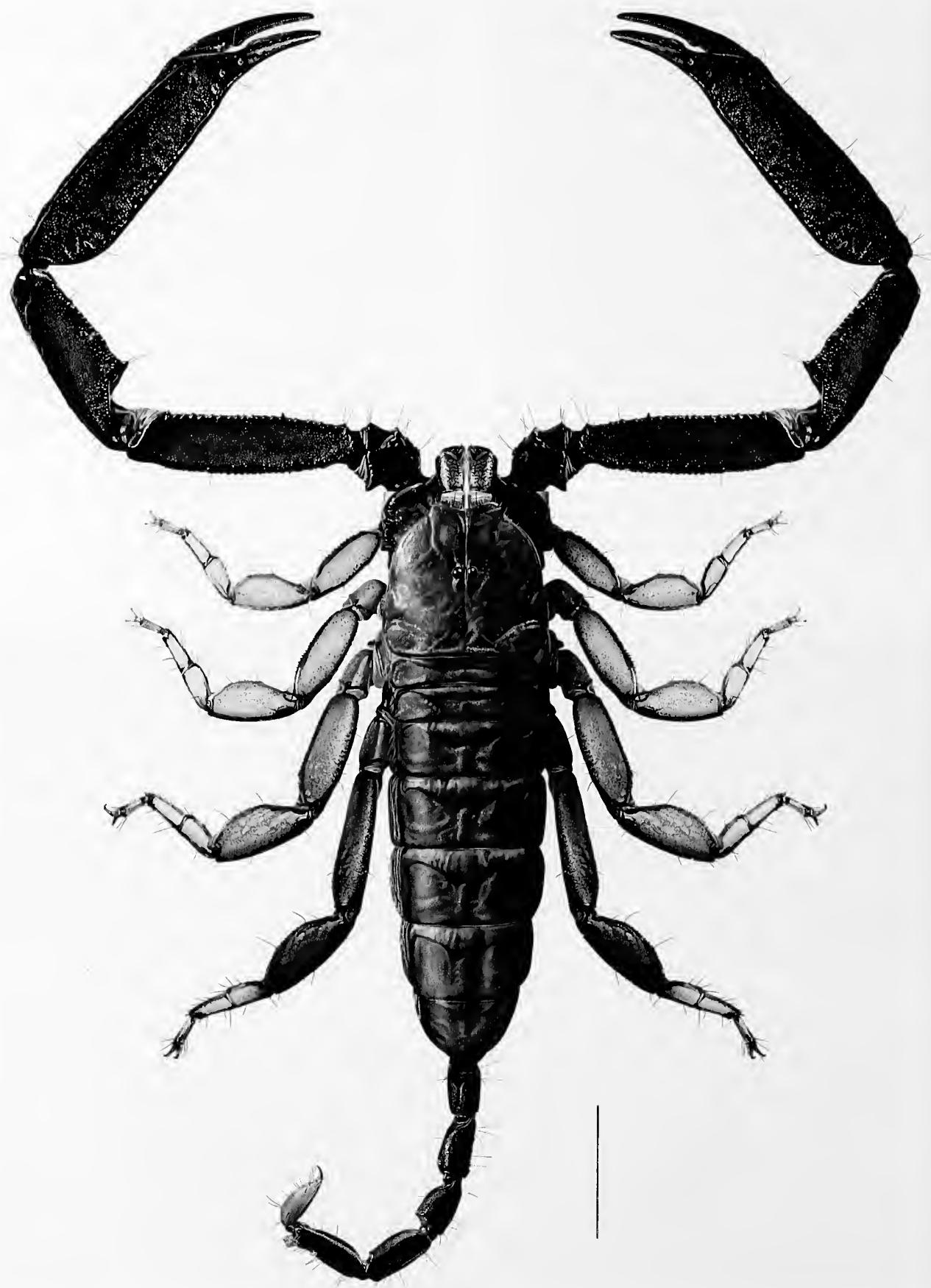


Fig. 2. *Hormiops davidovi* Fage, 1933, habitus of male, dorsal aspect, reconstruction based on scientific illustrations and photographs of live specimens. Scale, 5 mm.

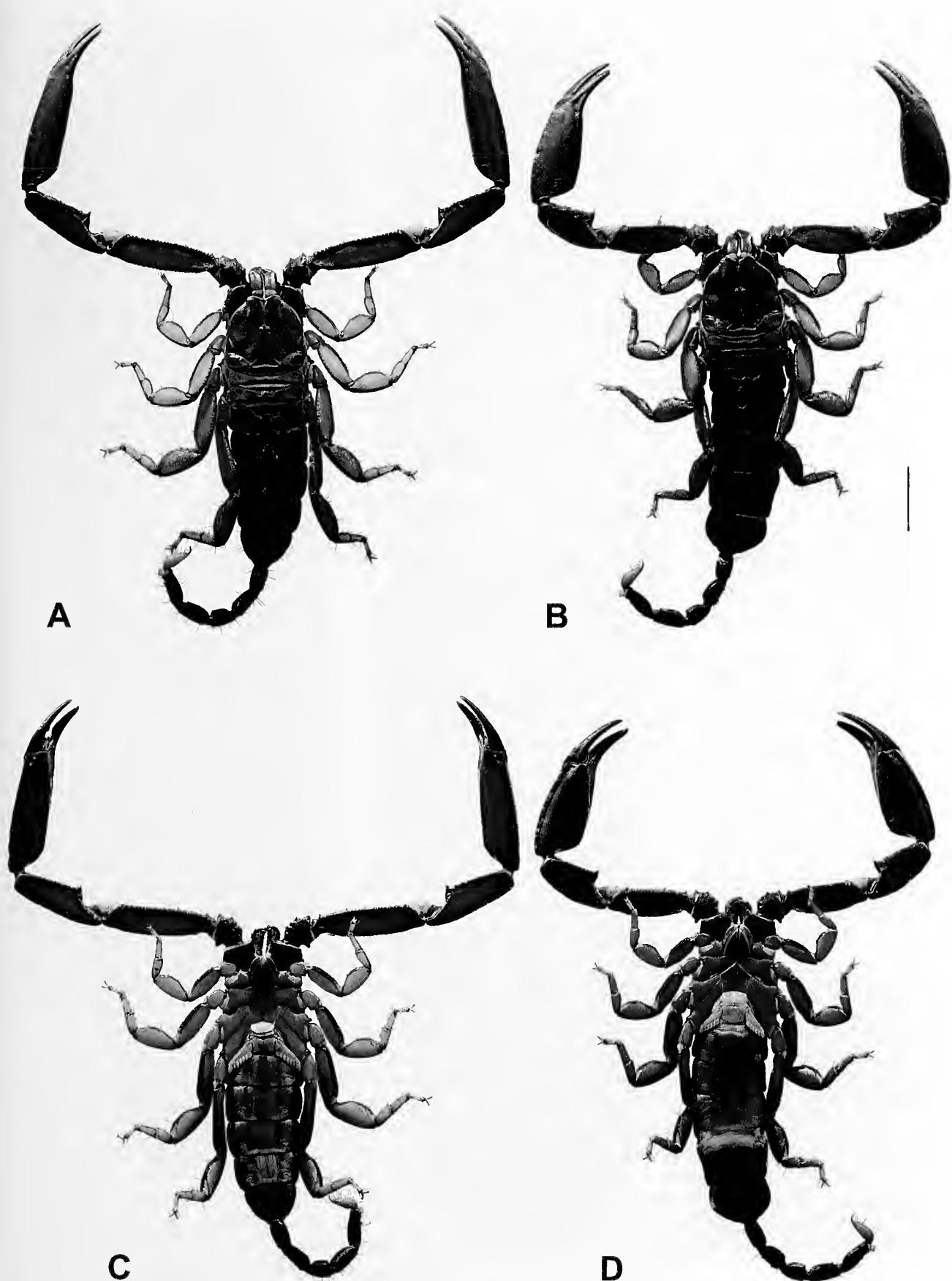


Fig. 3. *Hormiops davidovi* Fage, 1933, habitus, dorsal (A-B) and ventral (C-D) aspects. (A, C) Male (MHNG, sample VMI-12/04). (B, D) Female (MHNG, sample VMI-12/04). Scale, 5 mm.

Material: *Types:* MNHN-RS 0562; male lectotype, 1 female and 1 juv. paralectotypes; Vietnam, Poulo Condore [=Côn Sơn Island, N $8^{\circ}42'00''$ E $106^{\circ}36'00''$], S off the coast of Vietnam; in forest, under stones; II.1930/IV.1931; M. C. Dawyoff. – *Other material:* MNHN-RS 0499; 1 female, 11 juv.; Vietnam, Poulo Condore Island [=Côn Sơn Island, N $8^{\circ}42'00''$ E $106^{\circ}36'00''$]; M. Germain. – MHNG; 1 male, 3 females; sample VMI-12/01, Côn Đảo NP, Côn Sơn Island, trail to Ong Dung Beach; rainforest, in rock crevices (granitic boulders); 8.I.2012; leg. L. Monod. – MHNG; 4 males, 4 females, 20 juv.; sample VMI-12/02, Côn Đảo NP, Côn Sơn Island, trail to Soy Ray plantation, N $8^{\circ}41'$ E $106^{\circ}35'$; 50-180 m, rainforest, in rock crevices; 9.I.2012; leg. L. Monod. – MHNG; 2 males, 4 females; sample VMI-12/04, Côn Đảo NP, Côn Sơn Island, trail to Dat Tham Beaeh, N $8^{\circ}42'$ E $106^{\circ}35'$; 150 m, rainforest, in rock crevices; 10.I.2012; leg. L. Monod. – MHNG; 1 male, 5 females, 2 juv.; sample VIM-12/07, Côn Đảo NP, Côn Sơn Island, trail to Dam Tre Bay, N $8^{\circ}44'$ E $106^{\circ}39'$; 15-70 m, rainforest, in rock crevices; 11.I.2012; leg. L. Monod. – MHNG; 1 female; sample VMI-12/10, Côn Đảo NP, Ba Island, N $08^{\circ}38'$ E $106^{\circ}33'$; rainforest, in rock crevices; 12.I.2012; 60 m, leg. L. Monod.

Description of adult male: *Coloration:* Dorsal surface of chelicera manus orange-brown, with darker infuscation; fingers dark brown to black (Figs 1A, 2). Carapace and tergites dark brown to black. Pedipalps reddish brown, with darker infuscation; carinae and fingers black. Legs yellow to orange, prolateral carina of femora black, femora and patellae II-IV with darker infuscation. Coxapophyses I-II and sternites orange to dark brown; coxapophyses III-IV, sternum, genital operculum and pectines yellowish to orange-brown. Metasoma dark brown to black. Telson yellow, aculeus reddish black.

Cuticle: Non-granular surfaces of carapace, pedipalps, legs, mesosoma and metasoma finely punctated.

Carapace: Anterior margin with shallow median notch (Fig. 4A). Anterior furcated sutures vestigial. Median ocular tubercle situated anteromedially, very low, small, occupying about one ninth of carapace width at that point; superciliary carinae absent; median ocelli present, at least twice the size of lateral ocelli, separated by at least half diameter of median ocellus. Two pairs of lateral ocelli equal in size, equidistant and adjacent to one another. Postocular carapace margin without spines or tubercles. Surfaces finely and densely granular (creating a matte appearance) except anteriorly; anterolateral surfaces and frontal lobes smooth, fine granulation restricted to surface adjacent to median longitudinal sulcus (Fig. 4A, C).

Chelicerae: Median and basal teeth of fixed finger fused into a bicusp. Dorsal margin of movable finger with four teeth (one subdistal and one basal); dorso-distal tooth smaller than ventro-distal tooth; ventral margin smooth.

Pedipalps: Pedipalp segments long and slender (Figs 1A, 2, 3A, C, 5B-E, G-J, L-O), with femur length approximately 1.5 times carapace length (Tab. 1). Chela almost asetose.

Chela fingers: Dentate margins of fixed and movable fingers linear (without lobe and notch) distally, with two rows of primary denticles of similar size, these rows merged to each other basally, accessory denticles absent (Fig. 6A-B). Fixed finger: basal lobe weakly developed; suprabasal notch well developed (Figs 6A-B, 7A). Movable finger: basal lobe absent; suprabasal lobe well developed, wider than high, gently rounded dorsally, not overlapping fixed finger; suprabasal lobe and corresponding suprabasal notch on fixed finger contiguous, no proximal gap or at most a reduced gap evident when fingers closed.

Pedipalp carinae: Femur (Fig. 5L-O): internomedian ventral carina vestigial, comprising two large spiniform granules situated proximally and medially on segment; internomedian dorsal carina vestigial, comprising a single basal spine; dorsointernal carina with coarse spiniform granules, more strongly developed than dorsoexternal carina; dorsoexternal carina developed as a band of granules in proximal half and as an almost smooth ridge in distal half; ventroexternal carina with coarse spiniform granules; ventromedian carina obsolete, granular proximally; ventrointernal carina with coarse spiniform granules. Patella (Fig. 5G-J): prolateral dorsal and prolateral ventral spiniform processes equally developed and fused medially, forming a prominent median spine, angled approximately 45° relative to longitudinal axis of segment; internodorsal carina with coarse spiniform granules; dorsomedian carinae developed as a band of granules proximally, and as a smooth ridge medially; dorsoexternal carina distinct, developed as a faint costate ridge; externomedian carina granular; ventroexternal carina distinct, developed as a smooth or faintly costate ridge; ventrointernal carina with coarse spiniform granules. Chela manus (Fig. 5B-E): dorsal secondary carina obsolete; digital carina distinct, costate to granular, more strongly developed than external secondary carinae; external secondary carinae weakly developed, granular; ventroexternal carina costate; ventromedian and ventrointernal carinae obsolete; internomedian carina distinct, granular.

Pedipalp chela macrosculpture: Femur (Fig. 5L-O): dorsal intercarinal surface smooth, fine granulation limited to proximal and retrolateral edges; retrolateral intercarinal surface smooth, sparsely granular ventrally; ventral intercarinal surface granular proximally, distal half smooth; prolateral intercarinal surface finely granular.

Patella (Fig. 5G-J): dorsal intercarinal surface smooth, with prolateral edge and proximal end sparsely granular; retrolateral intercarinal surface smooth; ventral intercarinal surface smooth, with prolateral edge faintly granular; prolateral intercarinal surface finely granular, with distal extremity smooth. Chela manus (Fig. 5B-E): dorsal intercarinal surface with scattered granules fused into a reticulated network, becoming denser on prolateral and

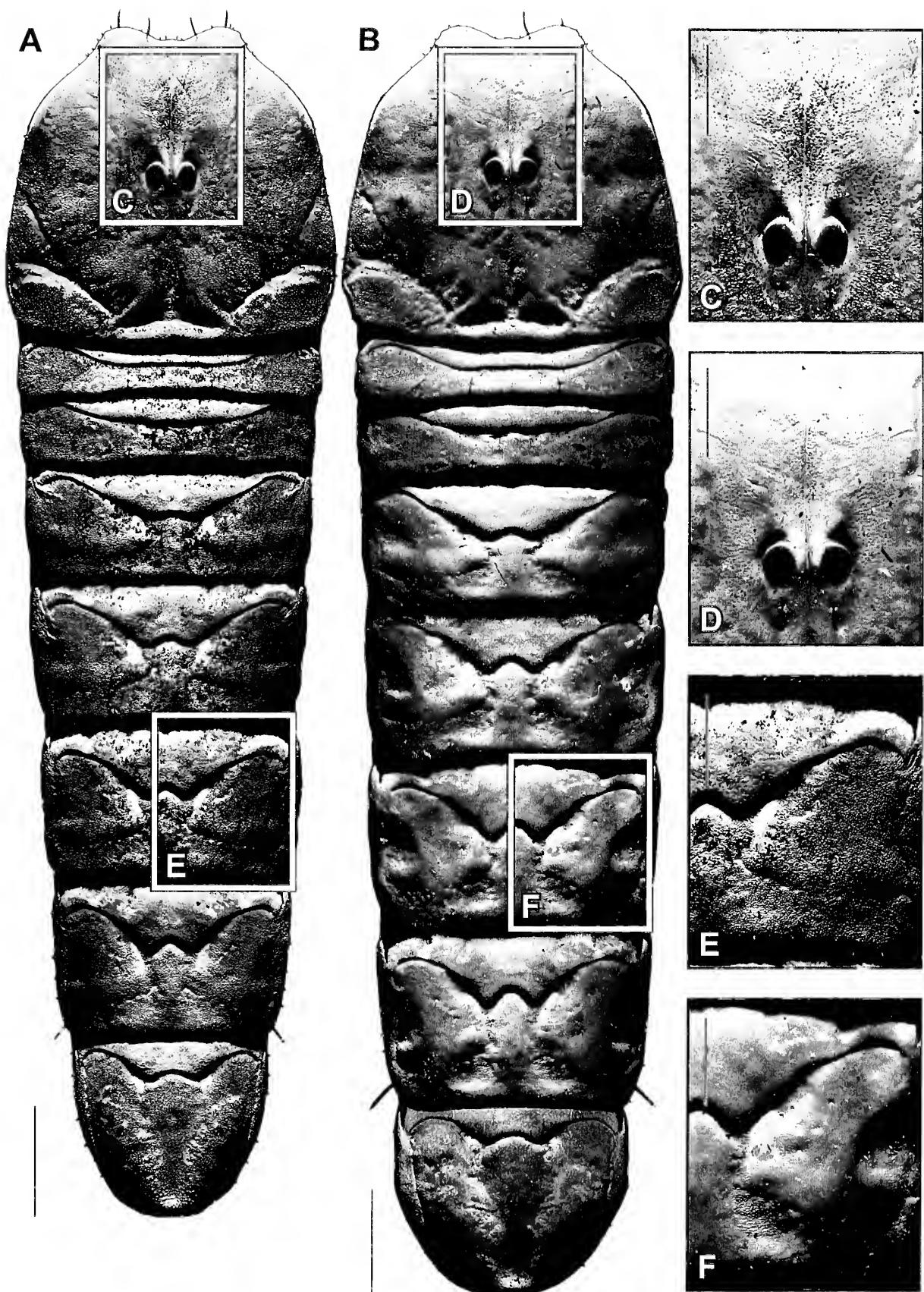


Fig. 4. *Hormiops davidovi* Fage, 1933, carapace and mesosomal tergites, illustrating ornamentation and macrosulpture of cuticle (A-B), with detailed view of carapace (C-D) and of tergite V (E-F), dorsal aspect. (A, C, E) Male (MHNG, sample VMI-12/04). (B, D, F) Female (MHNG, sample VMI-12/04). Scale, 2 mm (A, B), 1 mm (C-F).

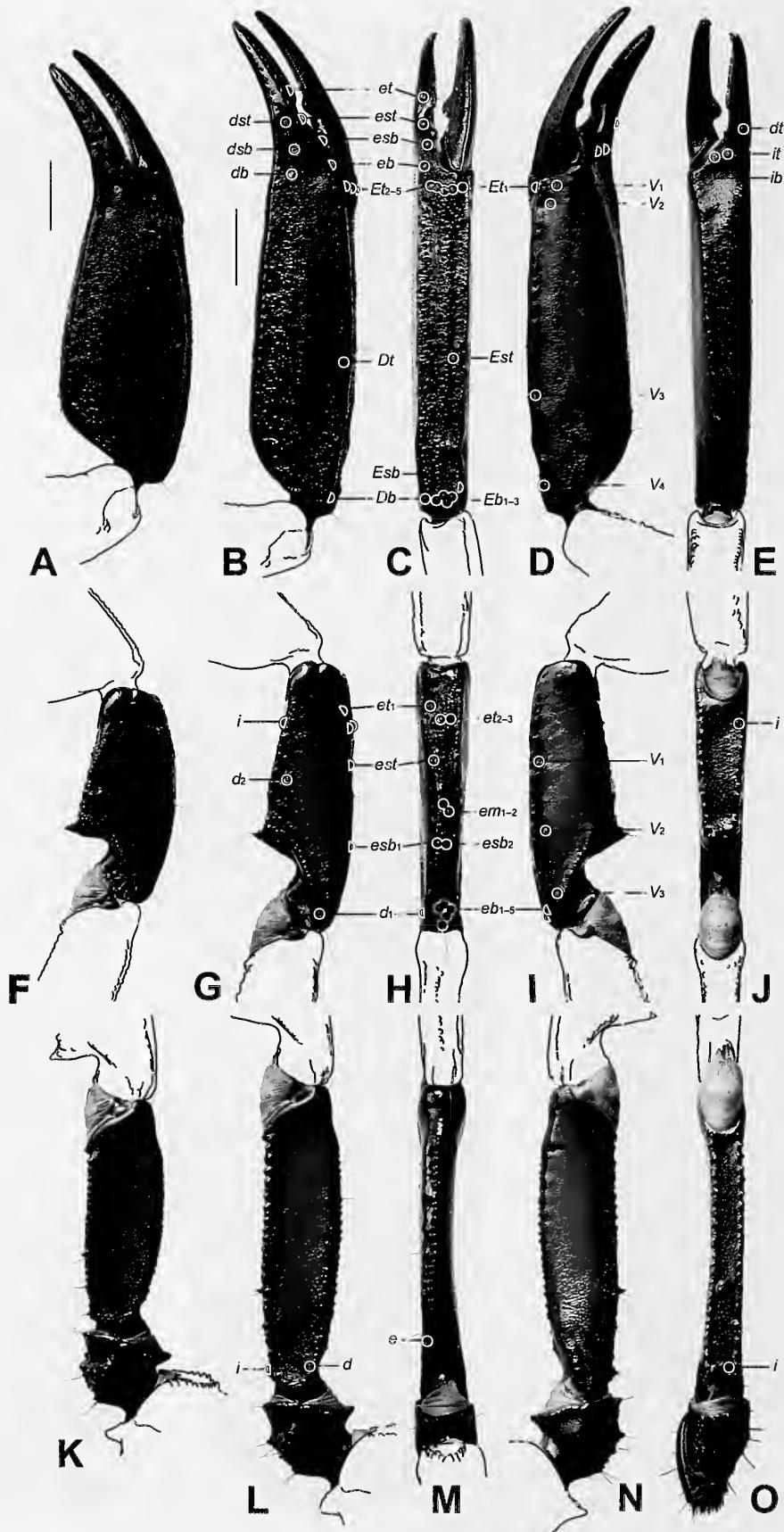


Fig. 5. *Hormiops davidovi* Fage, 1933, pedipalp chela (A-E), patella (F-J), femur and trochanter (K-O), dorsal (A, B, F, G, K, L), retrolateral (C, H, M), ventral (D, I, N) and prolateral (E, J, O) aspects showing trichobothrial pattern. (A, F, K) Female (MHNG, sample VMI-12/04). (B-E, G-J, L-O) Male (MHNG, sample VMI-12/04). Scales, 2 mm.

Table 1. *Hormiops davidovi* Fage, 1933, measurements (in mm) of adult males and females.

Status	Lectotype	Paralectotype											
		male	male	male	male	male	male	female	female	female	female	female	female
Sex	MNHN	MNHG	MNHG	MNHG	MNHG	MNHG	MNHN	MNHN	MNHG	MNHG	MNHG	MNHG	MNHG
Repository	RS 0562	VM-12/02	VM-12/02	VM-12/04	VM-12/04	VM-12/04	RS 0562	VM-12/01	VM-12/04	VM-12/04	VM-12/04	VM-12/04	VM-12/04
Registration/sample													
Total length	30	32	35	37	27	37	32	37	38	38	37	38	34
Carapace length	4.6	4.5	5.5	5.5	4.4	5.1	4.9	5.7	5.8	5.8	5.7	5.7	5.2
Carapace anterior width	2.2	2.5	2.7	2.8	2.2	2.5	2.4	2.8	3	3	2.8	2.8	
Carapace posterior width	4.6	5	5.9	6.1	4.6	5.5	5	6.3	6.4	6.4	6.3	6.4	5.7
Femur length	6.2	6.6	8.9	8.5	5.8	6.1	5.6	6.6	6.6	7.2	7.2	7.2	6.1
Femur width	1.8	2.1	2.3	2.3	1.8	2.1	2.1	2.3	2.3	2.4	2.4	2.4	2.1
Patella length	5.4	6	7.8	7.4	5.3	5.7	5.3	5.9	5.9	6.4	6.4	6.4	5.6
Patella width	2.1	2.4	2.9	2.5	2.1	2.4	2.4	2.5	2.8	2.9	2.9	2.9	2.5
Chela length	10.2	11.4	14.3	13.9	9.8	10.9	10.2	12.2	13.1	13.1	13.1	13.1	11.2
Chela manus width	2.5	2.5	2.9	2.9	2.4	3.2	3	3.8	3.8	4	4	3.8	3.1
Chela manus height	1.5	1.5	1.8	1.7	1.4	1.8	1.5	1.7	1.7	1.7	1.7	1.7	1.6
Chela movable finger length	4	4.4	5.3	5.3	4	4.2	4.5	5.4	5.4	6	5.4	5.4	5.1
Metasomal segment I length	1.6	1.5	1.9	1.9	1.5	1.7	1.5	2.1	2.1	1.9	1.9	1.9	1.6
Metasomal segment I width	1.2	1.2	1.4	1.3	1	1.2	1.2	1.4	1.4	1.4	1.4	1.4	1.2
Metasomal segment V length	2.2	2.5	2.9	2.9	2.2	2.5	2.3	2.8	2.8	2.9	2.8	2.8	2.4
Metasomal segment V width	0.7	0.7	0.8	0.8	0.7	0.8	0.8	0.8	0.8	0.9	0.9	0.9	0.8
Metasomal segment V height	0.9	1	1.1	1.1	0.9	1.1	1	1.1	1.1	1.2	1.2	1.2	1
Telson vesicle width	0.7	0.8	0.9	0.8	0.7	0.8	0.8	0.8	0.8	0.9	0.9	0.9	0.8
Telson vesicle height	0.7	0.8	0.9	0.9	0.7	0.8	0.8	0.8	0.9	0.9	0.9	0.9	0.8

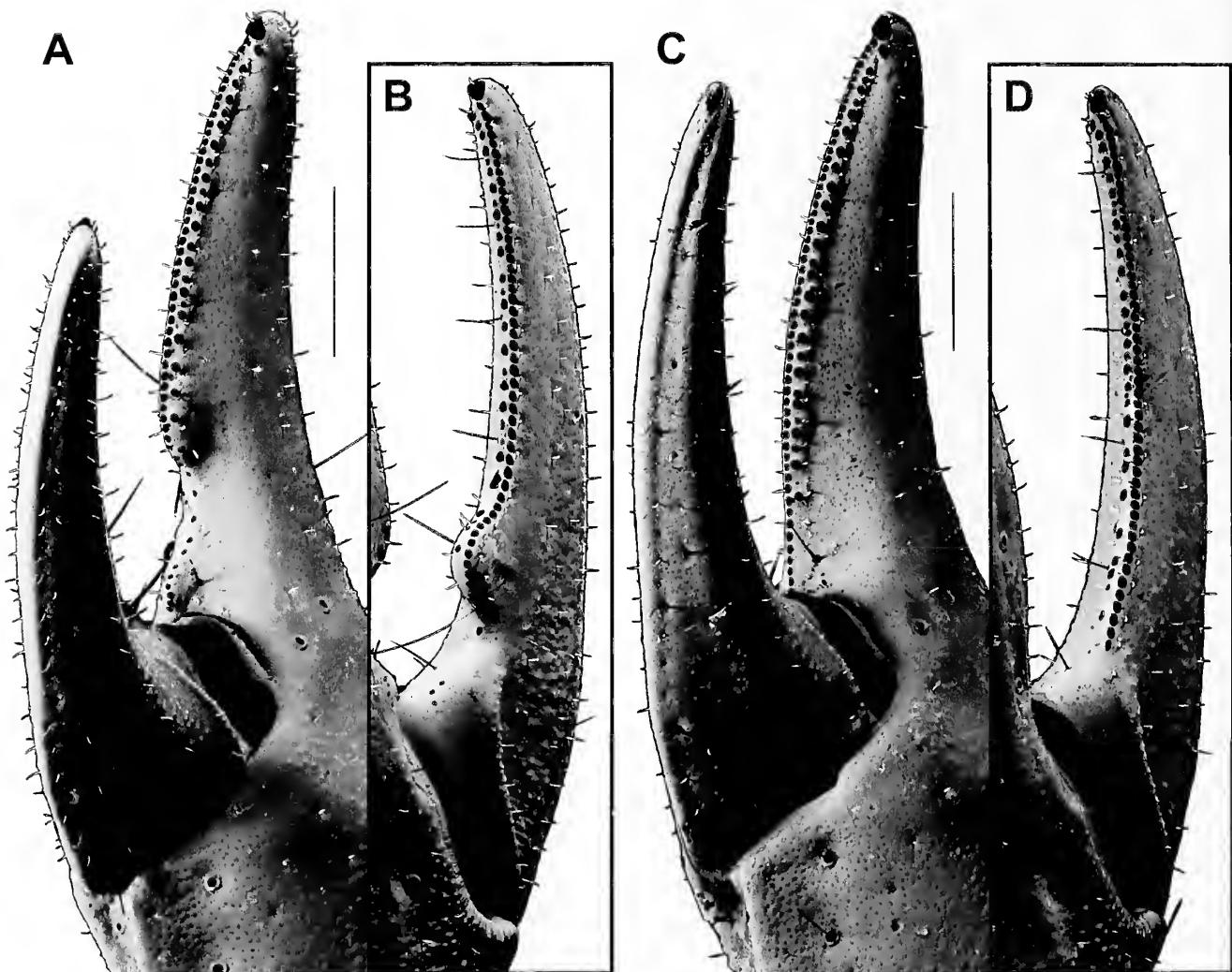


Fig. 6. *Hormiops davidovi* Fage, 1933, pedipalp chela, dentate margins of fixed (A, C) and movable (B, D) fingers. (A-B) Male (MHNG, sample VMI-12/04). (C-D) Female (MHNG, sample VMI-12/04). Scale, 1 mm.

retrolateral edges; retrolateral intercarinal surface granular; ventral intercarinal surface smooth, with retrolateral edge faintly granular; prolateral intercarinal surface sparsely granular. Chela fingers smooth; surface around *db*, *dsb* and *dst* trichobothria of fixed finger smooth. Trichobothria: Pedipalp orthobothrioxic, accessory trichobothria absent (Fig. 5B-E, G-J, L-O). Patella: *d*₂ trichobothria distal to patellar process; five *eb* trichobothria arranged in two groups *eb*/*eb*_{4,5} and *eb*_{2,3}; two *esb* trichobothria; two *em* trichobothria; one *est* trichobothrium; three *et* trichobothria; three *V* trichobothria. Chela manus with *Dt* situated slightly proximal to midpoint; *Eb*₃ situated close to *Eb*_{1,2}; *Esb* basal, aligned with *Eb* series; *Est* situated at or near midpoint; four *V* trichobothria, with *V*₃ and *V*₄ separated. Fixed chela finger with *db* situated on dorsal surface; *esb*, *eb*, *est* and *et* equidistant (distance *est-esb* similar to distance *esb-eb*); *eb* situated at base of finger, proximal to point of articulation between fixed and movable fingers, above *esb-et* axis;

esb situated at base of finger, proximal to point of articulation between fixed and movable fingers, below *est-et* axis; two *i* trichobothria proximal to base of fixed finger. *Coxosternal region*: Leg III coxae without swelling or bulge anterodistally. Sternum equilateral pentagonal (Fig. 8A); anterior width slightly exceeding posterior width; length exceeding posterior width.

Legs: Femora I-IV with ventral surfaces bicarinate, proventral and retroventral carinae granular. Retroventral margins of tibiae I and II without setiform macrosetae. Pro- and retroventral margins of basitarsi I-IV with 4 spiniform macrosetae. Telotarsi I-IV: pro/retroventral margins each with 4/5, 4/5, 4/5 and 5/5 setiform macrosetae (Fig. 9D-E); ventromedian row of spinules absent; dorsomedian lobe pronounced; laterodistal lobes truncate; unguis curved, shorter than telotarsus.

Genital operculum composed of two subtriangular sclerites (Fig. 8A).

Pectines: Moderately elongated, distal edge reaching but

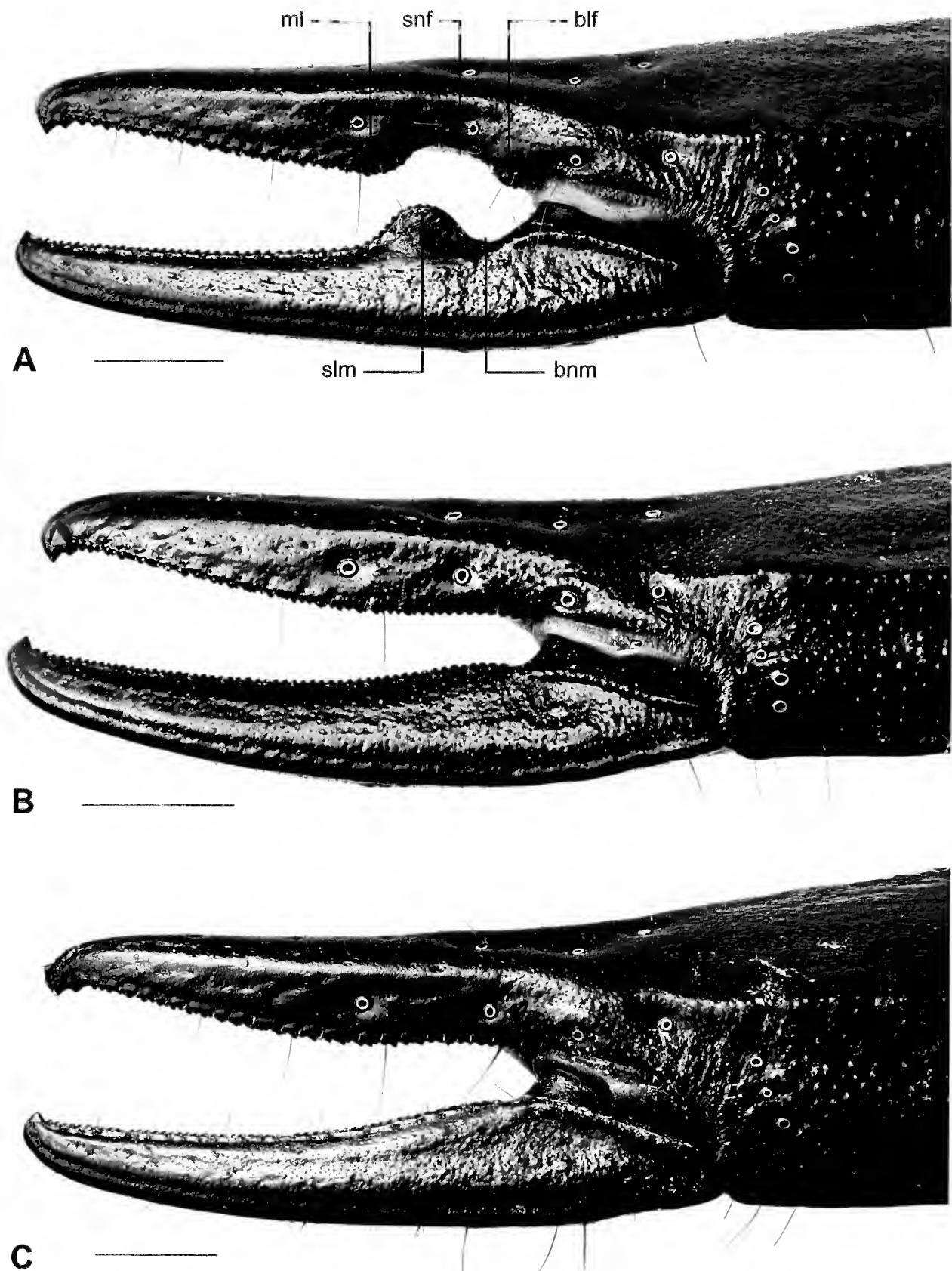


Fig. 7. *Hormiops davidovi* Fage, 1933, pedipalp chela, retrolateral aspect showing dentate margin of chela fingers. (A) Male (MHNG, sample VMI-12/04). (B) Male (MHNG, sample VMI-12/07). (C) Female (MHNG, sample VMI-12/04). Abbreviations: blf = basal lobe, fixed finger, bnm = basal notch, movable finger, ml = median lobe, slm = suprabasal lobe, movable finger, snf = suprabasal notch, fixed finger. Scale, 1 mm.

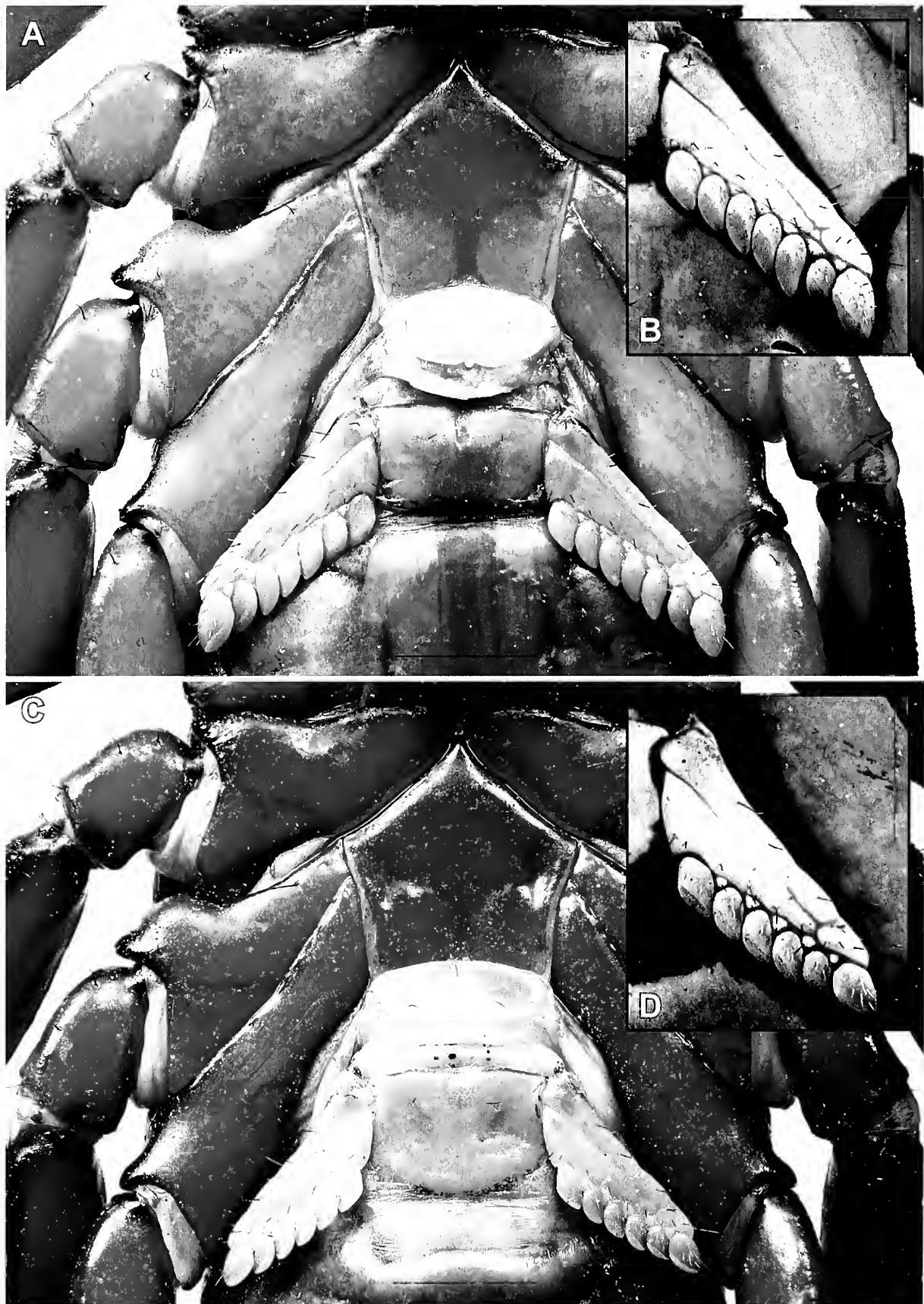


Fig. 8. *Hormiops davidovi* Fage, 1933, coxae of legs II-IV, sternum, genital operculum and pectines, ventral aspect (A, C), left pectine under UV light (B, D). (A-B) Male (MHNG, sample VMI-12/04). (C-D) Female (MHNG, sample VMI-12/04). Scales, 1.5 mm (A, C), 1 mm (B, D).

not surpassing distal edge of leg IV coxa (Fig. 8A); fulcra and three marginal lamellae present (Fig. 8B). Pectinal teeth count 7/7; teeth short, straight, only covered with sensory papillae distally.

Mesosoma: Tergites I to VII gradually decreasing in width. Posterior margins of pre-tergites I-VII smooth (Fig. 4A, E). Post-tergites: posterior margins of I-VI sublinear, without distinct prominence (Fig. 4A, E); lateral transversal sulcus absent or vestigial (shallow) on I-IV; intercarinal surfaces of I-VII finely and densely granular (creating a matte appearance), even, without reticulated network of ridges and dimples. Respiratory stigmata (spiracles) of sternites IV-VI short (less than one third of sternite width) and crescent-shaped, with distinct curve. Sternite VII acarinate.

Metasoma: Length similar to that of female (Tab. 1); intercarinal surfaces smooth, with sparse minute granules. Segment I flattened dorso-ventrally (wider than high, wider than following segments, lower than following segments) (Fig. 9B-C); segments II-V laterally compressed (higher than wide); segments I-IV each with median sulcus shallow to absent; dorso-submedian and dorsolateral carinae obsolete; ventrolateral and ventro-submedian carinae distinct at least on some segments. Segment I: dorsomedian posterior spiniform granules weakly developed or absent; posterior spiniform granules of dorsosubmedian carinae weakly developed or absent, not noticeably larger than preceding granules; lateral median carina distinct anteriorly; ventrolateral and ventro-submedian carinae converging to same point near posterior margin of segment; ventrolateral carinae each with small spiniform granules posteriorly and none medially; ventro-submedian carinae distinct in anterior half, fused into a single carina in posterior half, with small spiniform granules posteriorly and even smaller granules medially; all granules pointing anteriorly. Segment II: dorsomedian posterior spiniform granules weakly developed or absent; posterior spiniform granules of dorso-submedian carinae weakly developed to absent, not noticeably larger than preceding granules; ventrolateral carinae each with one large spiniform granule posteriorly and with smaller granules scattered subposteriorly and medially; each ventro-submedian carinae with one large and one to two smaller spiniform granules medially, one large spiniform granule sub-posteriorly, and none to two small spiniform granules posteriorly; all granules pointing anteriorly. Segments III and IV: posterior spiniform granules of dorso-submedian carinae distinctly larger than preceding granules; ventrolateral carinae and ventro-submedian carinae weakly developed, smooth, without larger spiniform granules. Segment V: dorsal intercarinal surface smooth; dorsolateral carinae obsolete; ventrolateral carinae distinct, anterior half with small spiniform granules, posterior half with few larger spiniform granules; ventromedian carina expressed only in anterior half, with scattered small granules; anal areh with few large eonial spiniform granules; all granules pointing posteriorly.

Telson: Shorter than metasomal segment V (Fig. 9B); vesicle surfaces smooth.

Hemispermatophore and spermatophore (Figs 10-11): Distal lamina slightly curved, longer than basal part; distal crest absent; single laminar hook situated in basal third; basal extrusion absent; transverse ridge distinct, approximately aligned with base of laminar hook, merging with ental edge at base of laminar hook. Capsular lamella thin, folded only proximally and unfolded distally to flattened extremity (tip and base approximately of same width); longitudinal carina on dorsal surface weak to absent; accessory hook and accessory lobe absent; lamellar tip approximately aligned with base of laminar hook, distal to tip of distal lobe. Distal lobe well developed, not hook-like, without accessory hook, carinae or crest. Basal lobe well developed, spoon-shaped, merging with ental process; ectal edge without accessory fold, forming 90° angle with lamella; ental edge without accessory fold toward ectal part, forming 90° angle with lamella.

Book lungs: Lamellar surfaces with regularly spaced, simple trabeculae, each with a knoblike tip (Fig. 12A-B); distal edges of lamellae covered with areuate structures formed by fusion of bent cuticular processes (Fig. 12C, D); posterior edge of spiracle smooth, margin close to atrial wall with hillock-like structures and with chisel-like structures ending in broad, flat tip (Fig. 12E-F).

Description of adult female: Same characters as in male except as follows.

Colouration: Legs darker than in males (Fig. 1C cf. Fig 1A).

Pedipalps: All segments noticeably shorter and more robust than in male (Figs 1C, 3B, D, 5A, F, K). Dentate margins of chela fingers linear or nearly so, i.e. without pronounced lobe and notch (Figs 6C, D, 7C). Prolateral process of patella angled approximately perpendicular to longitudinal axis of segment (Fig. 5F).

Carapace: Surface smooth except for sparsely and finely granular areas along posterior part of lateral margins and median longitudinal sulci (Fig. 4B, D).

Genital operculum: Oval to semi-oval, wider than long, approximately same width as posterior margin of sternum (Fig. 8C); opercular sclerites partly fused, median suture distinct; posterior notch present, at least weakly developed.

Pectines: Short, distal edge not reaching distal edge of coxa IV (Fig. 8C). Pectinal teeth count 6/6; areas of teeth covered with sensory papillae smaller than in males (Fig. 8D).

Mesosoma: Post-tergites: lateral transversal sulcus on III-VI slightly deeper than in male (Fig. 4B, F cf. Fig. 4A, E); intercarinal surfaces of I-II smooth, weakly granular laterally; intercarinal surfaces of III-VI smooth, weakly granular laterally and in submedian sulci; intercarinal surfaces of VII smooth, with few minute granules scattered along posterior half of lateral margins.

Metasoma: Intercarinal surfaces smooth (Fig. 9A).

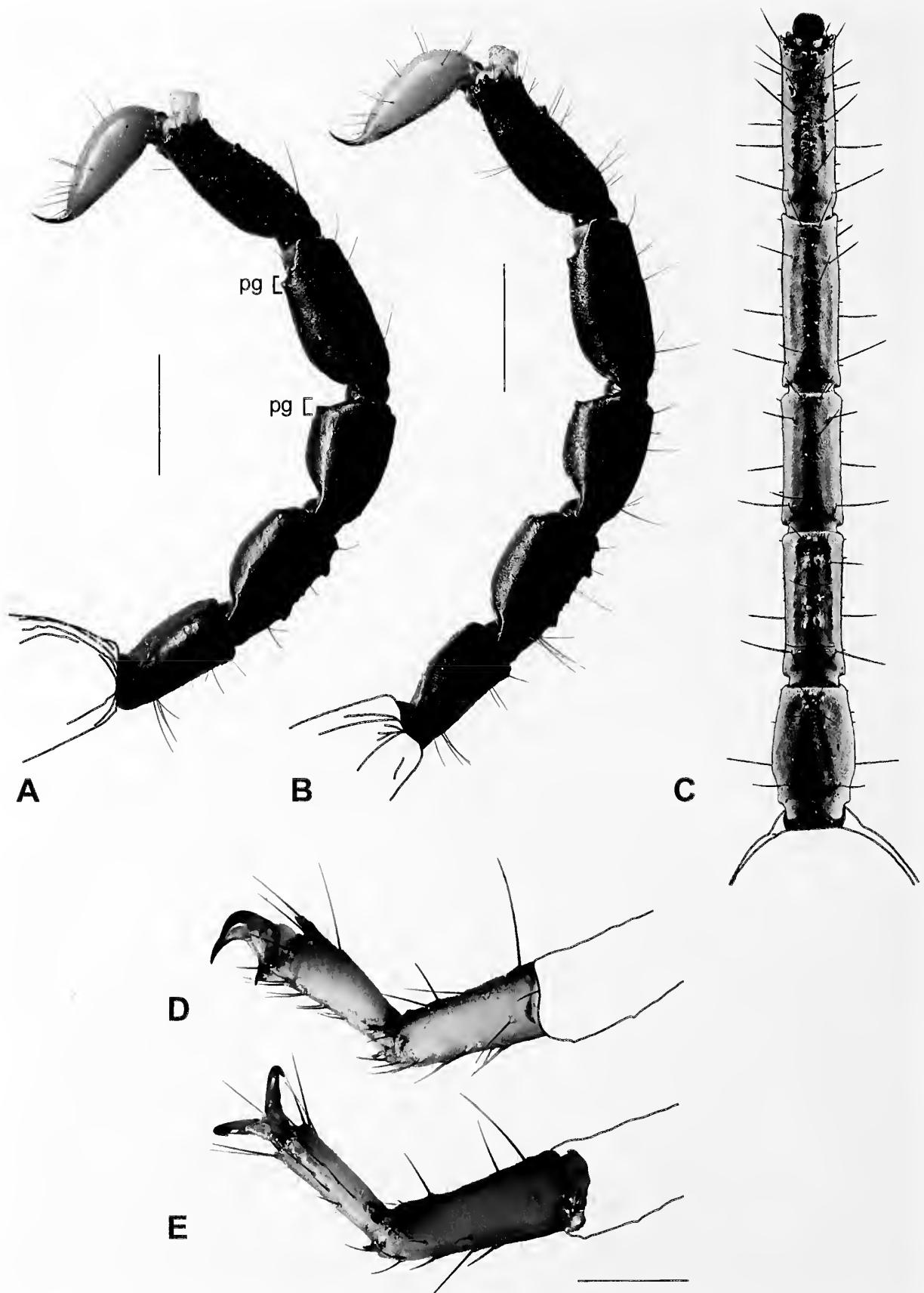


Fig. 9. *Hormiops davidovi* Fage, 1933, metasoma and telson, lateral (A-B) and ventral (C) aspects; left tarsus IV, retrolateral (D) and ventral (E) aspects. (A) Female (MHNG, sample VMI-12/04). (B-E) Male (MHNG, sample VMI-12/04). Abbreviation: pg = posterior granules, dorso-submedian carinae. Scale, 2 mm (A-C), 1 mm (D-E).

Sexual dimorphism: The pedipalps of males and females are strongly dimorphic (Figs 1A, C, 3, 5). They differ between the sexes not only in length compared to body size, but also in allometric slopes (Fig. 13A; H_0 : slopes are equal, likelihood ratio statistic: 4.279, P-value = 0.038587). Pedipalps are positively allometric in males (slope = 1.618793; lower limit = 1.227101, upper limit = 2.135513; H_0 : slope not different from 1, test statistic: r = 0.8025, P-value = 0.0029489), whereas in females they are isometric (slope = 1.1532493, lower limit = 0.9662842, upper limit = 1.37639; H_0 : slope not different from 1, test statistic: r = 0.3514, P-value = 0.10882).

Intraspecific variation: Large males have proportionally longer pedipalps than small males, as indicated by the positive allometry (Fig. 13A). The development of the suprabasal lobe of the movable finger and of the corresponding suprabasal notch in the fixed finger also varies among males. The suprabasal lobe can be reduced to a low, barely visible hump, or it can even be absent (dentate margins of pedipalp chela fingers thus being straight) in some specimens (Fig. 7B), usually the smaller ones. Pectinal teeth count varies from 6 to 7 in males (n = 11, mode = 7) and females (n = 22; mode = 6).

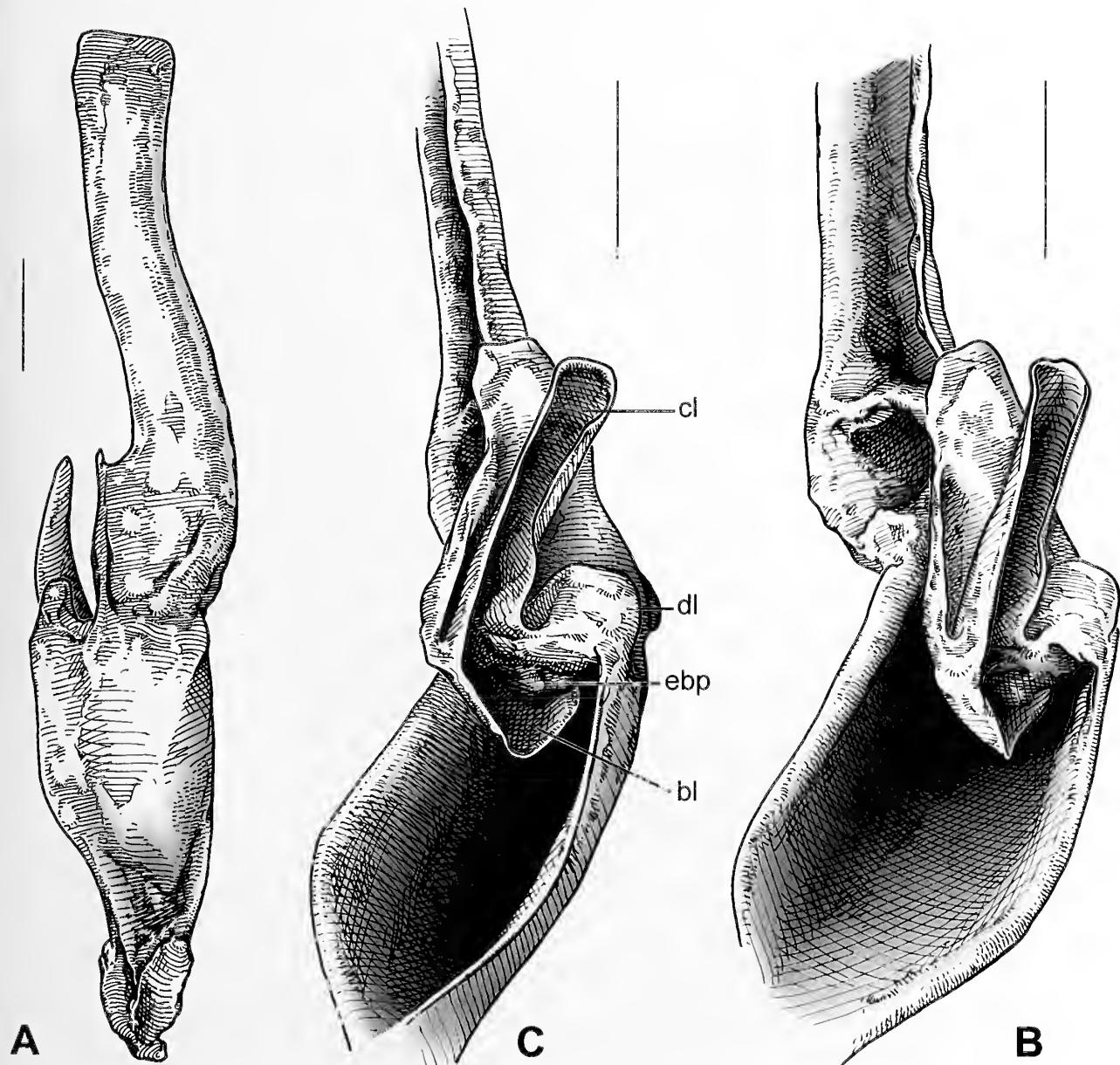


Fig. 10. *Hormiops davidovi* Fage, 1933, male (MHNG, sample VMI-12/04), left hemispermatophore. (A) Dorsal aspect. (B-C) Detail of capsular region, ental (B) and ventral (C) aspects. Abbreviations: bl = basal lobe, cl = capsular lamella, dl = distal lobe, ebp = ental basal process. Scale, 0.5 mm.

Distribution and ecology: *Hormiops davidovi* is only known from, and probably endemic to, the Côn Đảo Archipelago, a group of granitic islands near the southern tip of Vietnam (Fig. 14). Specimens were collected from narrow rock crevices of granitic outcrops in primary evergreen forests (Fig. 15). The habitat and habitus are consistent with the lithophilous ecomorphotype (Prendini, 2001).

Conservation status: The known populations of *H. davidovi* are located on several protected islands that are part of the Côn Đảo National Park. The land area of these islands represents less than 80 km², which designates *H. davidovi* as a short-range endemic, i.e. a species with a distribution area of less than 10,000 km² (Harvey, 2002; Monod & Volschenk, 2004). Although currently not threatened by habitat destruction,

H. davidovi is vulnerable to potential threats from tourism and loss of habitat in the future given its restricted distribution range. It is thus recommended that *H. davidovi* be placed on the IUCN Red List of near threatened species (International Union for the Conservation of Nature, 2001).

***Hormiops infulcra* Monod, 2014**

Figs 1B, D, 13B, 16-28, Tab. 2

Hormiops davidovi. – Kovářík, 2000: 57-58, figs 1-7. [mis-identification]

Hormiops infulcra. – Monod, 2014: 602-603, figs 1b, d, 2b, 3c, e, h, i.

Material: Holotype: MHNG; male; sample VMI-12/14, Peninsular Malaysia, Pahang, Pulau Tioman, trail from

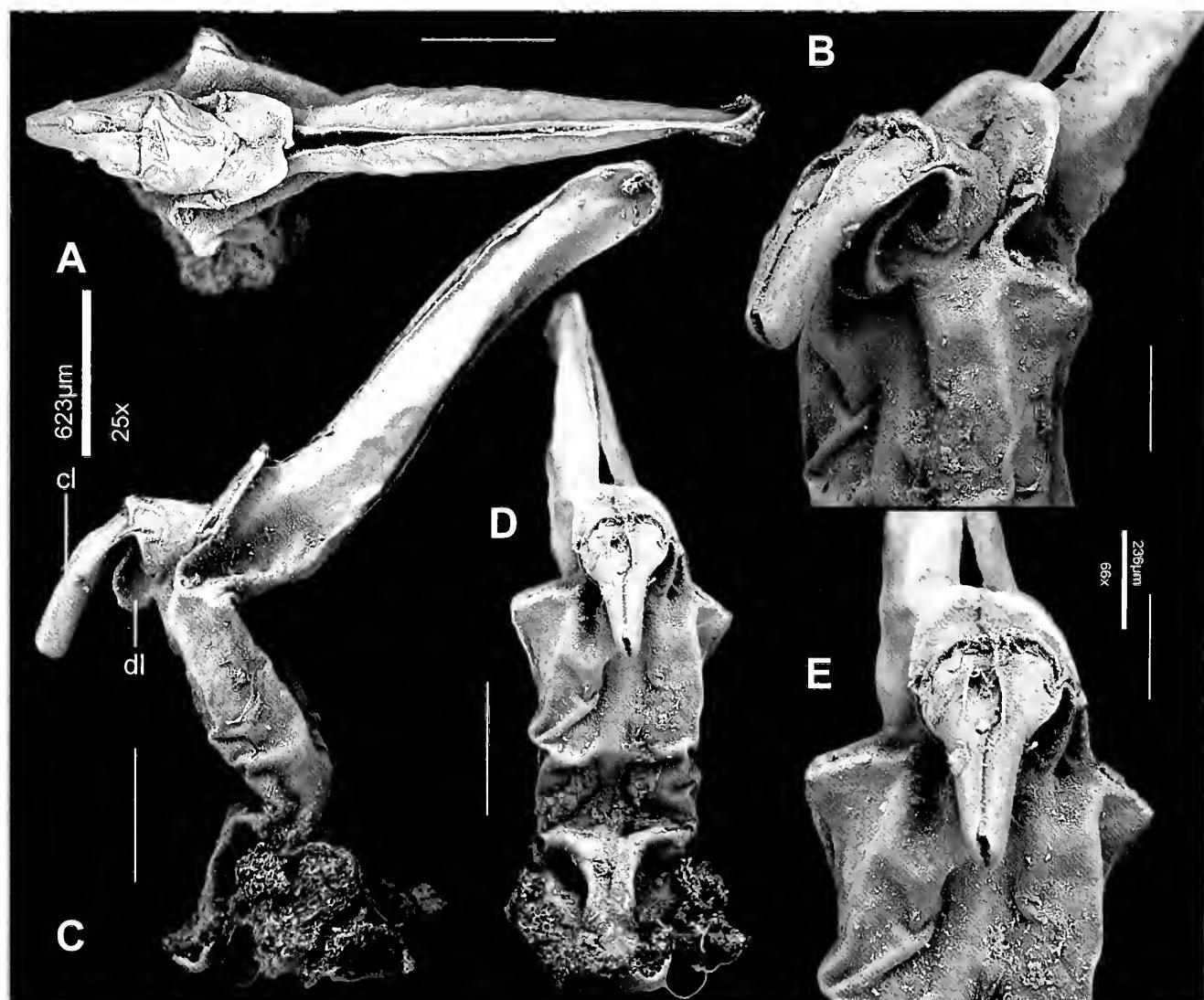


Fig. 11. *Hormiops davidovi* Fage, 1933, male (MHNG, sample VMI-12/01), post-insemination spermatophore. In toto, upper (A), lateral (C), and anterior (D) aspects. Detail of capsular region, rotated approximately 45° counter-clockwise from lateral aspect (B), anterior aspect (E). Abbreviations: cl = capsular lamella, dl = distal lobe. Scales, 0.5 mm (A, C-D), 0.25 mm (B, E).

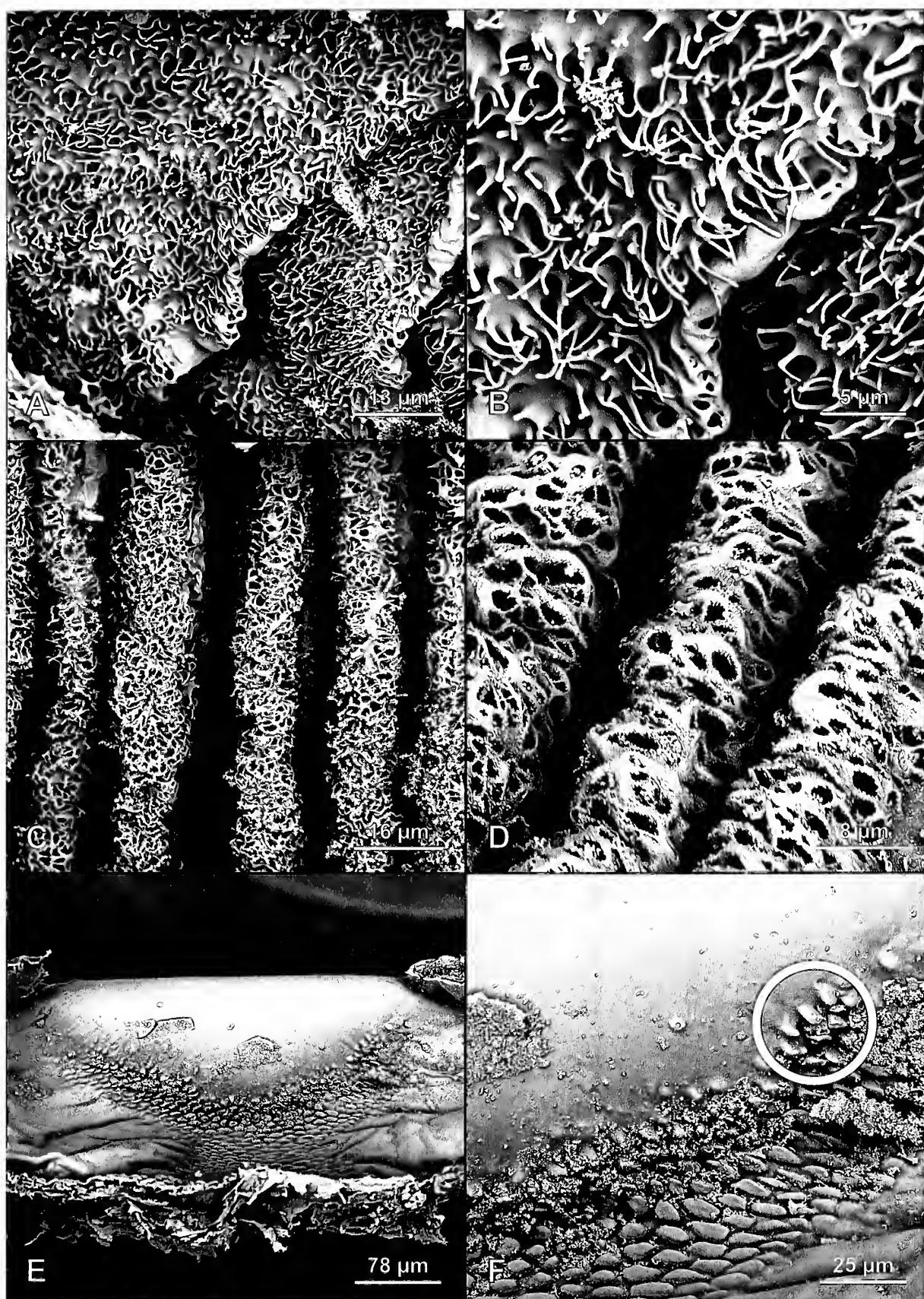


Fig. 12. *Hormiops davidovi* Fage, 1933, female (MHNG, sample VMI-12/04), book lungs. (A-B) Surface of book lung lamella with simple trabeculae. (C-D) Arcuate distal edges of book lung lamellae, posterior view. (D-E) Movable posterior edge of spiracle with hillock-like and chisel-like (circle) structures, anterior view.

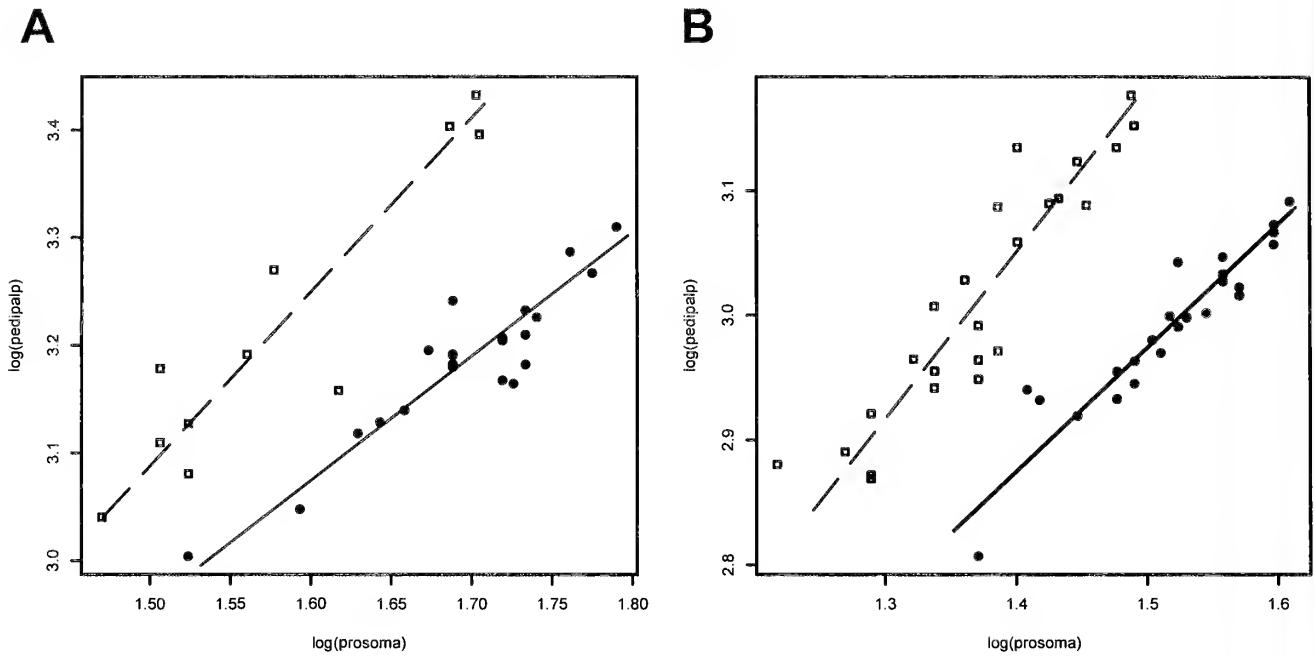


Fig. 13. Bivariate scatter plots of the pedipalp size (Y) versus body size (X) with fitted SMA lines for males (dashed lines, squares) and females (full lines, filled circles). (A) *Hormiops davidovi* Fage, 1933. (B) *Hormiops infulcra* Monod, 2014.

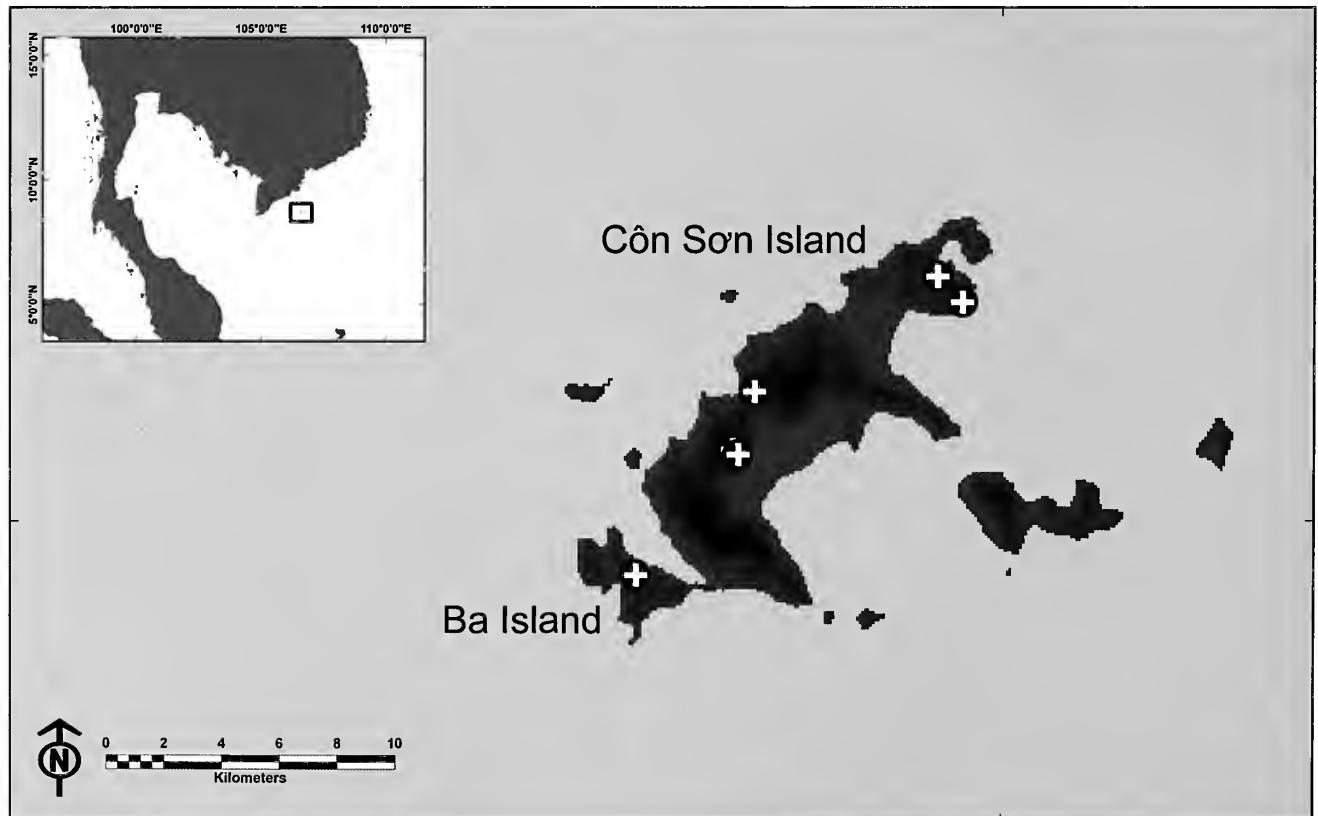


Fig. 14. Known localities of *Hormiops davidovi* Fage, 1933 in the Côn Đảo Archipelago, Vietnam, with topography indicated.



Fig. 15. Habitat of *Hormiops davidovi* Fage, 1933 on Côn Sơn Island, Côn Đảo Archipelago, Vietnam.

Kampung Genting to Paya, N $2^{\circ}46'$ E $104^{\circ}07'$; 70 m, rainforest, in rock crevices; 25.I.2012; leg. L. Monod.

Paratypes: MHNG; 3 males, 2 females, 5 juv.; same data as for holotype. – MHNG; 10 males, 13 females, 46 juv.; Pulau Tioman, foothills of Gunung Kajang, N $2^{\circ}47'$ E $104^{\circ}07'$; 60 m, rainforest, in rock crevices; 1-2.X.2001; leg. L. Monod. – MHNG; 4 males, 7 females, 14 juv.; sample VMI-12/12, Pulau Tioman, trail near Kampung Mukut, N $2^{\circ}44'$ E $104^{\circ}07'$; 115 m, rainforest, in rock crevices; 23.I.2012; leg. L. Monod. – MHNG; 4 males, 2 females, 2 juv.; sample VMI-12/13, Pulau Tioman, trail near Nipah, N $2^{\circ}45'$ E $104^{\circ}07'$; 25 m, rainforest, in rock crevices; 24.I.2012; leg. L. Monod. – MHNG; 2 males, 1 female; sample VMI-12/15, Pulau Tioman, trail from Japamala Resort to Kampung Lanting, N $2^{\circ}44'$ E $104^{\circ}07'$; 65 m, rainforest, in rock crevices; 27.I.2012; leg. L. Monod.

Other material: LKCM, ZRC.ARA.456; 1 female, 4 juv.; Peninsular Malaysia, Pahang, Pulau Tulai [N $2^{\circ}54'44''$ E $104^{\circ}06'26''$]; 23.VIII.2003; leg. P. K. L. Ng *et al.* – LKCM, ZRC.ARA.457; 1 juv.; same data as ZRC. ARA.456.

Diagnosis: *Hormiops infulcra* differs from *H. davidovi* by the following combination of characters. *Hormiops infulcra* is distinctly smaller and slightly lighter in colour than *H. davidovi* (Fig. 1). The carapace of males is slightly less densely granular in *Hormiops infulcra* (Fig. 18A, C) than in *H. davidovi* (Fig. 4A, C). The externoventral carinae of the pedipalp femur is finely granular in *H. infulcra* (Fig. 19M-N), whereas it bears coarse spiniform granules in *H. davidovi* (Fig.

5M-N). The dorsoexternal carina of the pedipalp patella in *H. infulcra* is costate-granular (Fig. 19G-H) and more distinct than the faint costate ridge observed in *H. davidovi* (Fig. 5G-H). The digital earina of the pedipalp chela is granular in *H. infulcra* (Fig. 19B-C), whereas it is costate in *H. davidovi* (Fig. 5B-C). In males of *H. infulcra* the dentate margins of the fixed and movable chela fingers are linear (Fig. 20A-B, 21A), whereas most males of *H. davidovi* possess a well-developed suprabasal lobe on the movable finger and a corresponding suprabasal notch on the fixed finger (Fig. 6A-B, 7A-B). The telotarsus IV has four proventral macrosetae in *Hormiops infulcra* (Fig. 23D-E), whereas they bear five in *H. davidovi* (Fig. 9D-E). In *Hormiops infulcra* the average number of pectinal teeth is six for males and five for females (Fig. 22), whereas males and females of *H. davidovi* usually have seven and six pectinal teeth respectively (Fig. 8). The pectinal fulcrae are absent in *H. infulcra* (Fig. 22), but present in *H. davidovi* (Fig. 8). The tergites of males are medially less granular in *H. infulcra* (Fig. 18A, E) than in *H. davidovi* (Fig. 4A, E). Moreover, in *H. infulcra* males, the posterior margins of tergites I-V are smooth medially and the median ridges are sometimes smooth as well (Fig. 18A, E), whereas in *H. davidovi* males the tergites are completely granular (Fig. 4A, E). The metasoma is finely and sparsely granular in *H. infulcra* (Fig. 23A-C), whereas in *H. davidovi* it is smooth or nearly so (Fig. 9A-C). The ventrosubmedian carinae of metasomal segment II have no granules posteriorly in *H. infulcra* (Fig. 23C), whereas in most specimens of *H. davidovi* they bear two small posterior

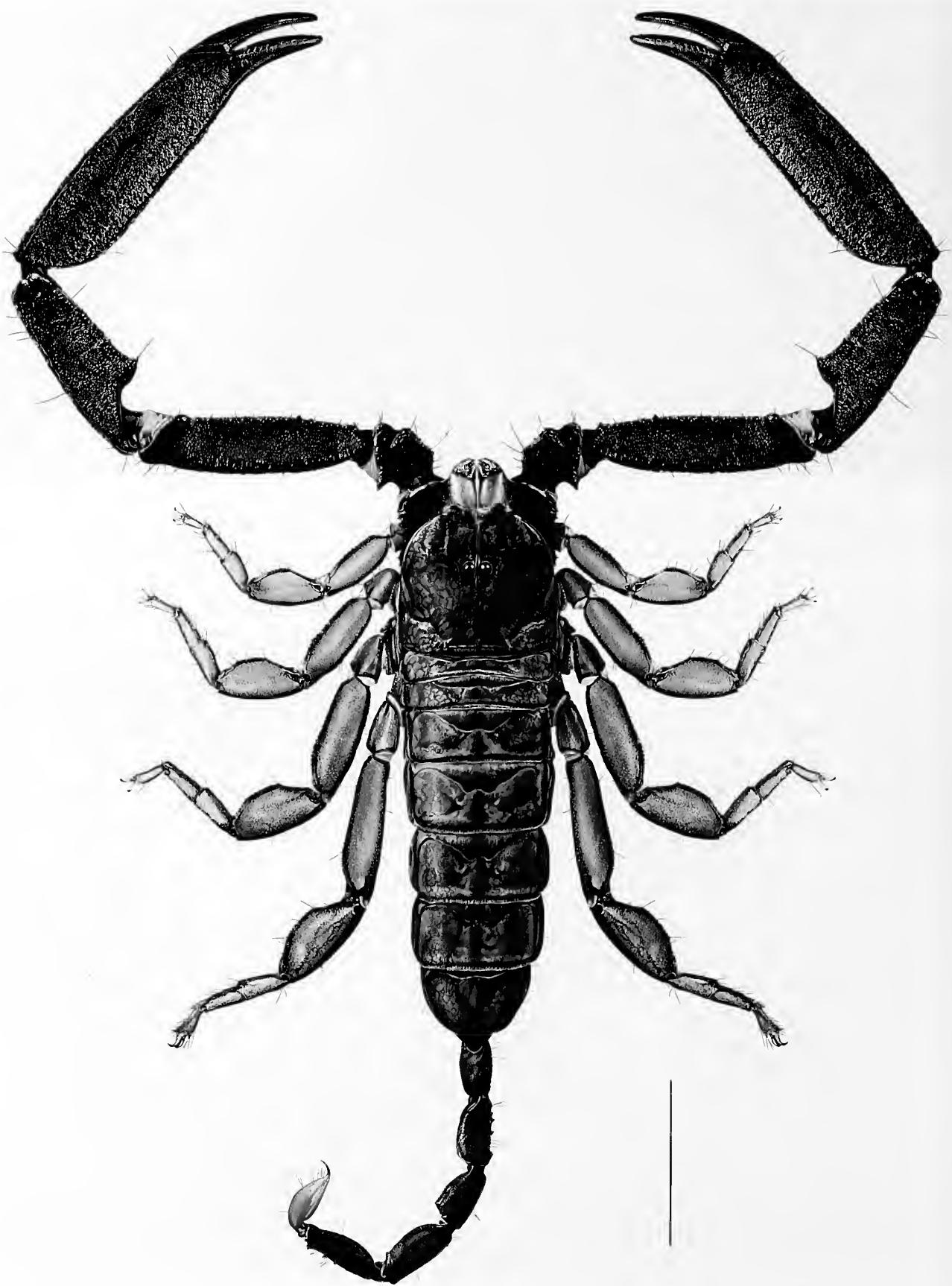


Fig. 16. *Hormiops infulcra* Monod, 2014, habitus of male, dorsal aspect, reconstruction based on scientific illustrations and photographs of live specimens. Scale, 5 mm.

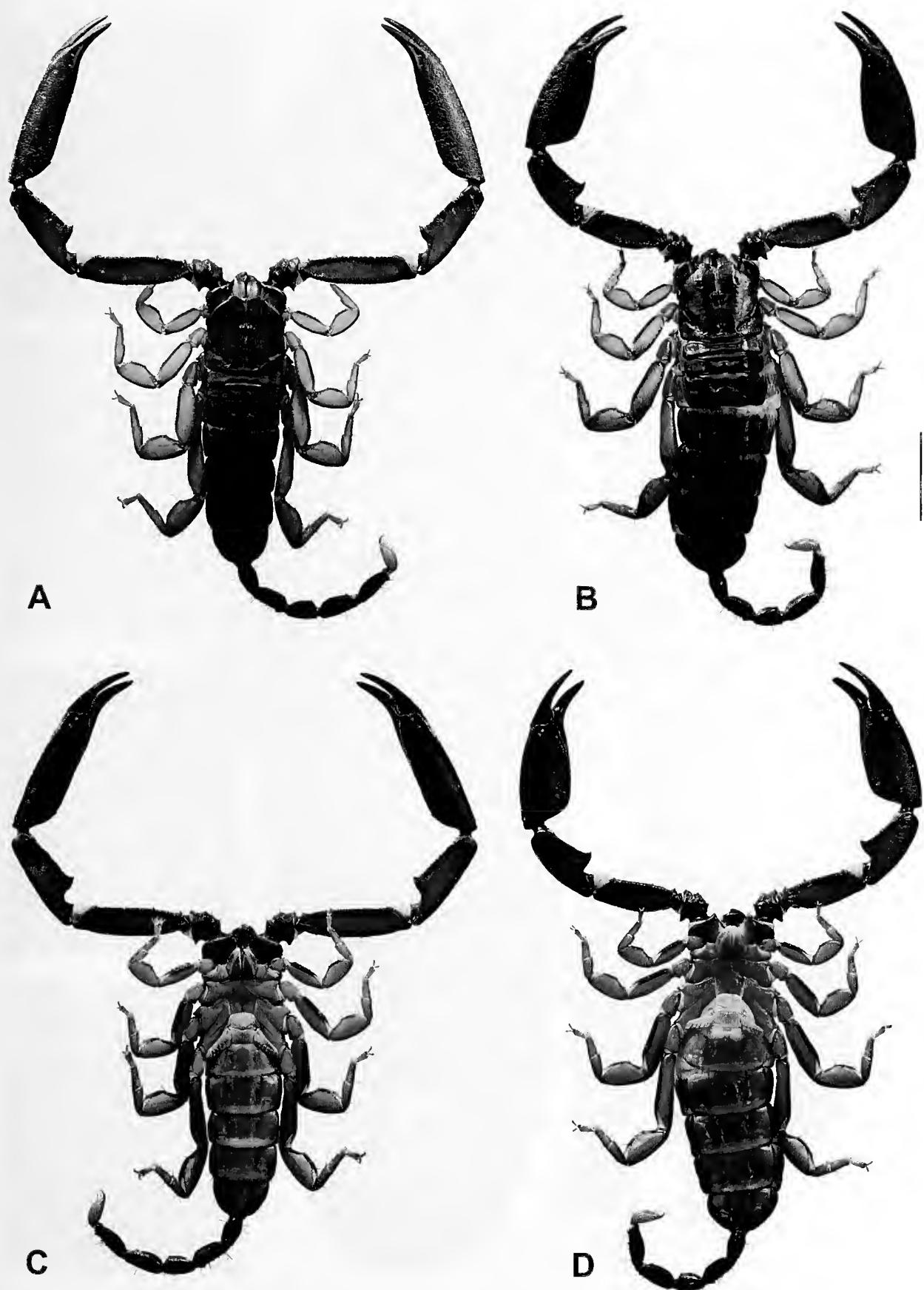


Fig. 17. *Hormiops infulcra* Monod, 2014, habitus, dorsal (A-B) and ventral (C-D) aspects. (A, C) Male holotype (MHNG, sample VMI-12/14). (B, D) Female paratype (MHNG, sample VMI-12/14). Scale, 5 mm.

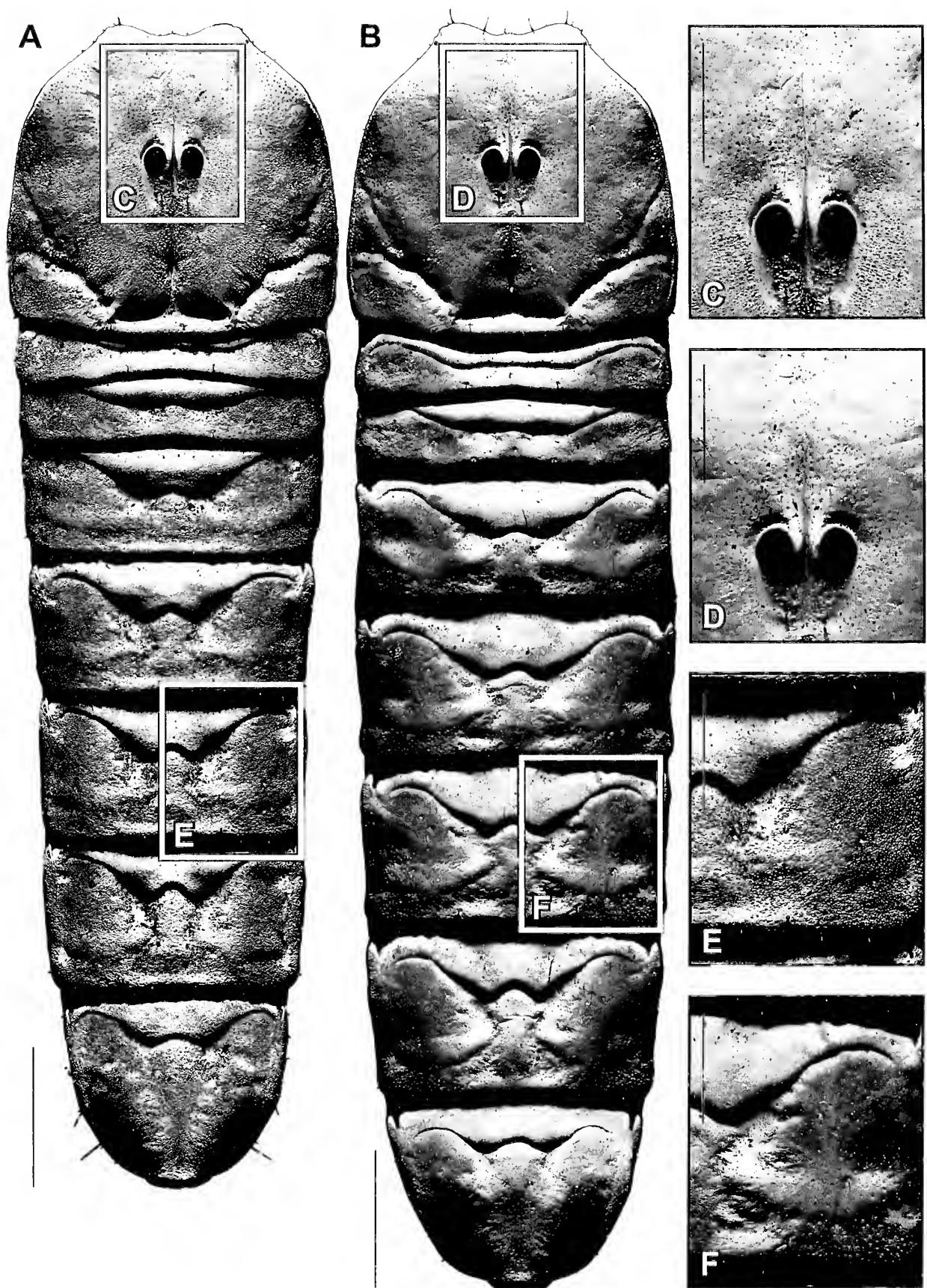


Fig. 18. *Hormiops infulcra* Monod, 2014, carapace and mesosomal tergites showing ornamentation and macrosulpture of cuticle (A-B), with detailed view of carapace (C-D) and tergite V (E-F), dorsal aspect. (A, C, E) Male holotype (MHNG, sample VMI-12/14). (B, D, F) Female paratype (MHNG, sample VMI-12/14). Scale, 2 mm (A-B), 1 mm (C-F).

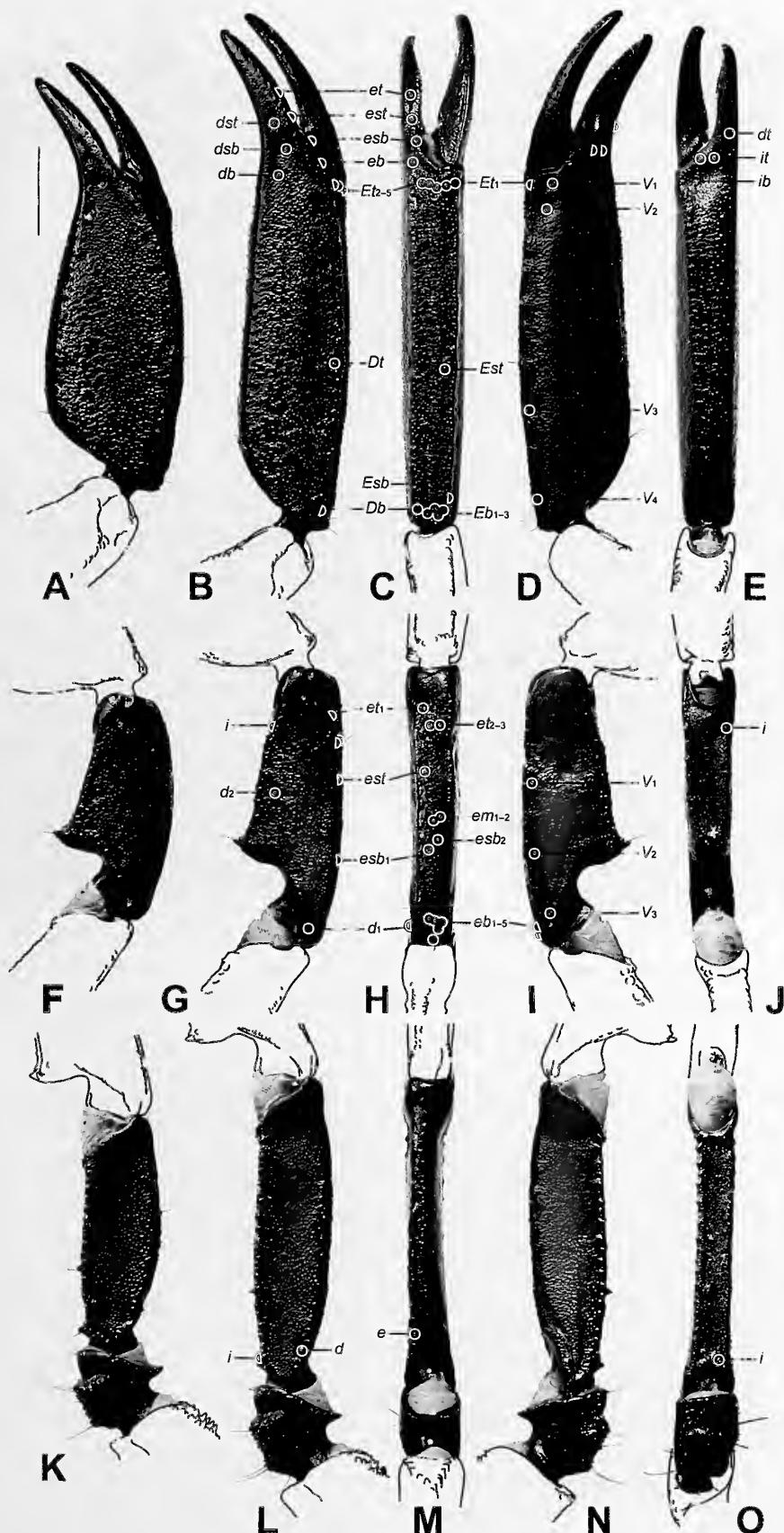


Fig. 19. *Hormiops infulcra* Monod, 2014, pedipalp chela (A-E), patella (F-J), femur and trochanter (K-O), dorsal (A-B, F-G, K-L), retrolateral (C, H, M), ventral (D, I, N) and prolateral (E, J, O) aspects showing trichobothrial pattern. (A, F, K) Female paratype (MHNG, sample VMI-12/14). (B-E, G-J, L-O) Male holotype (MHNG, sample VMI-12/14). Scale, 2 mm.

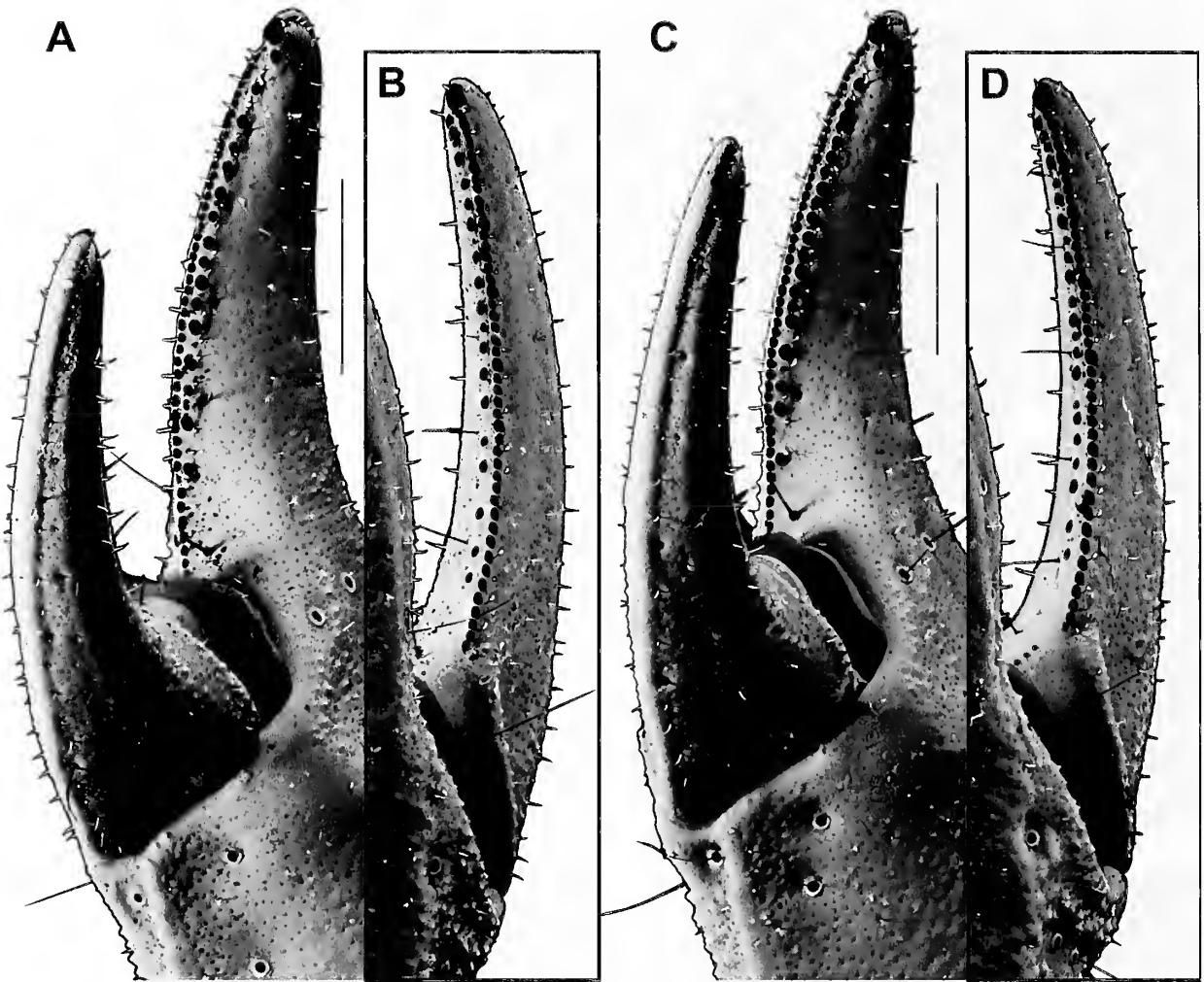


Fig. 20. *Hormiops infulcra* Monod, 2014, pedipalp chela, dentate margins of fixed (A, C) and movable (B, D) fingers. (A-B) Male holotype (MHNG, sample VMI-12/14). (C-D) Female paratype (MHNG, sample VMI-12/14). Scale, 1 mm.

spiniform granules (Fig. 9C). The distal lamina of the hemispermatophore is straight and only slightly longer than the basal part in *H. infulcra* (Figs 24A, 25A), whereas in *H. davidovi* it is slightly curved and longer than the basal part (Figs 10A, 11C).

Description of adult male: *Colouration:* Dorsal surface of chelicera manus orange-brown, with darker infuscation; fingers dark brown to black (Figs 1B, 16). Carapace reddish brown, with darker infuscations, tergites brown. Pedipalps reddish brown, with darker infuscation; carinae and fingers black. Legs orange brown to light brown, prolaternal carinae of femora black. Coxapophyses, sternum, genital operculum and pectines yellowish to orange-brown. Metasoma brown, with darker infuscations. Telson yellow, aculeus reddish black.

Cuticle: Non-granular surfaces of carapace, pedipalps and legs, mesosoma and metasoma finely punctate.

Carapace: Anterior margin with shallow median notch (Fig. 18A). Anterior furcated suture and sulci vestigial. Median ocular tubercle situated anteromedially, very

low, small, occupying about one ninth of earapace width; supraciliary carinae absent; median ocelli present, at least twice the size of lateral ocelli, separated by at least half the diameter of median ocellus. Two pairs of lateral ocelli, equal in size, equidistant and adjacent to one another. Postocular carapae margin without spines or tubercles. Surfaces finely and densely granular, giving tegument a matte appearance, except for anterior and median areas; anterolateral surfaces and frontal lobes smooth; median surface smooth, finely and densely granular around ocular tubercle (Fig. 18A, C).

Chelicerae: Median and basal teeth of fixed finger fused into a bicuspid. Dorsal margin of movable finger with four teeth (one subdistal and one basal); dorsal distal tooth smaller than ventral distal tooth; ventral margin smooth.

Pedipalps: Segments long and slender (Figs 1B, 16, 17A, C, 19B-E, G-J, L-O), with femur length approximately 1.5 times carapace length (Tab. 2). Chela almost asetose. *Chela fingers:* Dentate margins of fixed and movable fingers linear (without pronounced lobe and notch), with



Fig. 21. *Hormiops infulcra* Monod, 2014, pedipalp chela, retrolateral aspect showing dentate margin of chela fingers. (A) Male holotype (MHNG, sample VMI-12/14). (B) Female paratype (MHNG, sample VMI-12/14). Scale, 1 mm.

two rows of primary denticles, these rows merged to each other basally, accessory denticles absent, median row with few slightly larger denticles (Figs 20A-B, 21A).

Pedipalp earinae: Femur (Fig. 19L-O): internomedian ventral carina vestigial, comprising two large spiniform granules situated proximally and medially on article; internomedian dorsal carina obsolete, without granules; dorsointernal carina coarsely granular, more strongly developed than dorsoexternal carina; dorsoexternal earina coarsely granular, slightly less granular distally; ventroexternal carina granular; ventromedian carina obsolete; ventrointernal carina with coarse spiniform granules. Patella (Fig. 19G-J): prolateral dorsal and prolateral ventral spiniform processes equally developed and fused medially forming a prominent median spine, angled approximately 45° relative to longitudinal axis of segment; internodorsal carina with coarse spiniform granules; dorsomedian earinae granular proximally and medially, obsolete medially; dorsoexternal carina distinct and costate-granular; extermomedian carina granular; ventroexternal carina distinct, smooth to costate; ventrointernal carina with coarse spiniform granules. Chela manus (Fig. 19B-E): internomedian

carina granular; dorsal secondary carina obsolete; digital carina distinct, granular, more strongly developed than external secondary earina; external secondary carinae obsolete; ventroexternal carina costate; ventromedian and ventrointernal carinae obsolete.

Pedipalp surface macroseulpture: Femur (Fig. 19L-O): dorsal intercarinal surface faintly granular in proximal part and on retrolateral edge; retrolateral intercarinal surface granular; ventral intercarinal surface granular, distal extremity smooth; prolateral intercarinal surface finely granular. Patella (Fig. 19G-J): dorsal intercarinal surface faintly granular, distal extremity smooth; retrolateral intercarinal surface smooth; retrolateral dorsal intercarinal surface smooth; ventral intercarinal surface smooth, prolateral edge faintly granular; prolateral intercarinal surface finely granular, with distal extremity smooth. Chela (Fig. 19B-E): dorsal intercarinal surface with scattered granules fused into a reticulated network, becoming denser along prolateral and retrolateral edges; retrolateral intercarinal surface granular; ventral intercarinal surface faintly granular (anamostosed granules), smooth medially and distally; prolateral intercarinal surface granular, distal extremity

smooth. Chela fingers smooth; surface around *db*, *dsb* and *dst* trichobothria of fixed finger smooth.

Trichobothriotaxy: Pedipalp orthobothriotaxic, accessory trichobothria absent (Figs 19B-E, G-J, L-O). Patella: *d*, situated distal to patellar process; five *eb* trichobothria; two *esb* trichobothria; two *em* trichobothria; one *est* trichobothrium; three *et* trichobothria; three *V* trichobothria. Chela manus with *Dt* situated in proximal third; *Eb*₃ situated close to *Eb*_{1,2}; *Esb* basal, aligned with *Eb* series; *Est* situated at or near midpoint; four *V* trichobothria, with *V*₃ and *V*₄ clearly separated. Chela fixed finger with *db* situated on dorsal surface; *esb*, *eb*, *est* and *et* equidistant; *eb* situated at base of finger, proximal to point of articulation between fixed and movable fingers, above *esb-et* axis; *esb* situated at base of finger, proximal to point of articulation between fixed and movable fingers, below *est-et* axis; two *i* trichobothria proximal to base of fixed finger.

Coxosternal region: Leg III coxae without swelling or bulge anterodistally. Sternum equilateral pentagonal (Fig. 22A); anterior width slightly greater than posterior width; length slightly greater than posterior width.

Legs: Femora I-IV with ventral surfaces bicarinate, proventral and retroventral carinae granular. Retroventral margins of tibiae I and II without setiform macrosetae. Pro- and retrolateral margins of basitarsi I-IV each with four setiform macrosetae. Telotarsi I-IV: pro/retroventral margins each with 4/5, 4/5, 4/5 and 4/5 setiform macrosetae (Fig. 23D-E); ventromedian row of spinules absent; dorsomedian lobe pronounced; laterodistal lobes truncate; ungues curved, shorter than telotarsus.

Genital operculum composed of two subtriangular sclerites (Fig. 22A).

Pectines: Moderately elongated, distal edge reaching but not surpassing distal edge of leg IV coxa (Fig. 22A); fulcra absent, two marginal lamellae (Fig. 22B). Pectinal teeth count 6/6; teeth short, straight, only covered with sensory papillae distally.

Mesosoma: Tergites I to VII gradually decreasing in width. Posterior margins of pre-tergites I-VII smooth (Fig. 18A, E). Post-tergites: posterior margins of I-VI sublinear, without distinct prominence (Fig. 18A, E); lateral transversal sulcus absent or vestigial (shallow) on I-IV; intercarinal surfaces of I-VII even, without reticulated network of ridges and dimples; intercarinal surfaces of I finely and densely granular laterally, smooth medially; intercarinal surfaces of II-VI finely and densely granular (creating a matte appearance), posterior margin smooth medially, ridges weakly granular to smooth; intercarinal surface of VII finely and densely granular (creating a matte appearance). Respiratory stigmata (spiracles) of sternites IV-VI short (less than one third of sternite width) and crescent-shaped, with distinct curve. Sternite VII acarinate.

Metasoma: Length similar to that of female (Tab. 2); intercarinal surfaces sparsely and finely granular. Segment I flattened dorso-ventrally (wider than high,

wider than following segments, lower than following segments) (Fig. 23B-C); segments II-V compressed laterally (higher than wide); segments I-IV each with median sulcus shallow to absent; dorso-submedian and dorsolateral carinae obsolete; ventrolateral and ventro-submedian carinae distinct at least on some segments. Segment I: dorsomedian posterior spiniform granules weakly developed or absent; posterior spiniform granules of dorsosubmedian carinae weakly developed to absent, not noticeably larger than preceding granules; lateral median carina distinct anteriorly; ventrolateral and ventro-submedian carinae converging to same point near posterior margin of segment; ventrolateral carinae each with small spiniform granules posteriorly and none medially; ventro-submedian carinae distinct in anterior half, fused into a single carina in posterior half, with small spiniform granules posteriorly and even smaller granules medially; all granules pointing anteriorly. Segment II: dorsomedian posterior spiniform granules weakly developed or absent; posterior spiniform granules of dorso-submedian carinae weakly developed to absent, not noticeably larger than preceding granules; ventrolateral carinae each with one large spiniform granule posteriorly, plus smaller granules scattered subposteriorly and medially; each ventrosubmedian carinae with one to three large spiniform granules medially, one large spiniform granule sub-posteriorly, and no spiniform granules posteriorly; all granules pointing anteriorly. Segments III-IV: posterior spiniform granules of dorso-submedian carinae distinctly larger than preceding granules; ventrolateral and ventrosubmedian carinae weakly developed, densely and finely granular. Segment V: dorsal intercarinal surface smooth; dorsolateral carinae obsolete; ventrolateral carinae distinct, anterior half with small spiniform granules, posterior half with few larger spiniform granules; ventromedian carina expressed only in anterior half, with few small granules; anal arch with few large conical teeth; all granules pointing posteriorly. **Telson:** Shorter than metasomal segment V (Fig. 23B); vesicle surfaces smooth.

Hemispermatophore and spermatophore (Figs 24, 25): Distal lamina straight or nearly so, slightly longer than basal part; distal crest absent; single laminar hook situated in basal third; basal extrusion absent; transverse ridge distinct, approximately aligned with base of lamellar hook, merging with ental edge distal to laminar hook. Capsular lamella thin, folded only proximally and unfolded distally to flattened extremity (tip and base approximately of same width); longitudinal carina on dorsal surface absent to weak; accessory hook and accessory lobe absent; lamellar tip aligned with base of laminar hook, distal to tip of distal lobe. Distal lobe well developed, not hook-like, without accessory hook, carinae or crest. Basal lobe well developed, spoon-shaped, merging with ental basal process; ectal edge without accessory fold, forming 90° angle with lamella; ental edge without accessory fold toward ectal part, forming 90° angle with lamella.

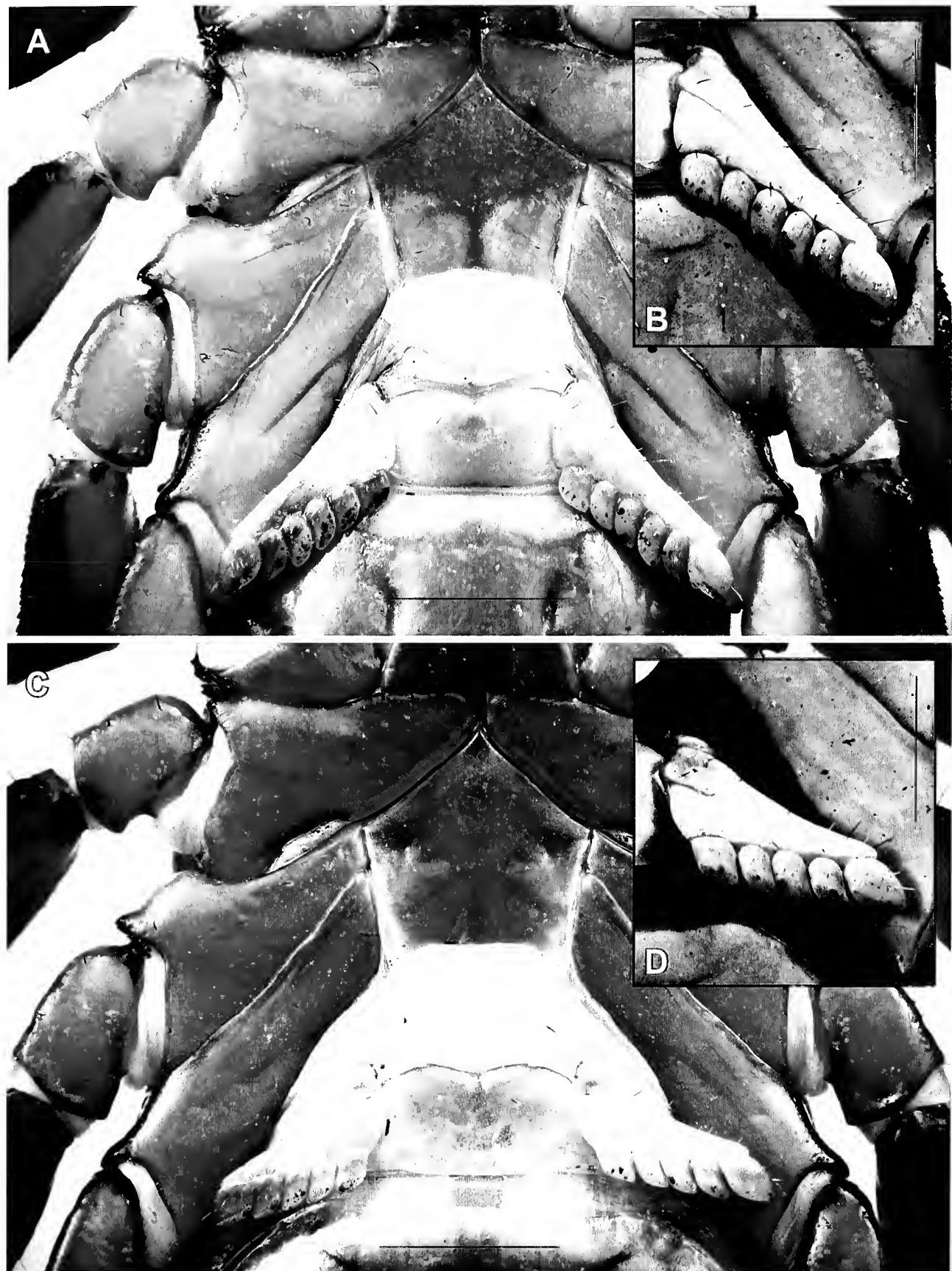


Fig. 22. *Hormiops infulcra* Monod, 2014, coxae of legs II-IV, sternum, genital operculum and pectines, ventral aspect (A, C), left pectine under UV light (B, D). (A-B) Male holotype (MHNG, sample VMI-12/14). (C-D) Female paratype (MHNG, sample VMI-12/14). Scales, 1.5 mm (A, C), 1 mm (B, D).

Table 2. *Hormiops influcra* Monod, 2014, measurements (in mm) of adult males and females.

Status	Holotype	Paratype male	Paratype male	Paratype male	Paratype male	Paratype female						
Sex	male	MHNG	MHNG	MHNG	MHNG	MHNG	MHNG	MHNG	MHNG	MHNG	MHNG	MHNG
Repository		VMI-12/14	VMI-12/12	VMI-12/12	VMI-12/13	VMI-12/12	VMI-12/13	VMI-12/12	VMI-12/13	VMI-12/14	VMI-12/13	VMI-12/14
Total length	28	24	26	23	27	28	27	28	27	28	31	30
Carapace length	4.4	3.6	3.9	3.4	4	3.9	4.6	4.8	4.6	4.8	4.5	5
Carapace anterior width	2.2	1.9	2.1	2	2.2	2.1	2.5	2.3	2.4	2.3	2.4	2.5
Carapace posterior width	4.8	3.9	4.3	3.8	4.3	4.1	5.3	5.1	5	5	5	5.8
Femur length	6.5	4.6	5.2	4.8	5.9	4	5	5.1	4.9	5.1	4.9	5.6
Femur width	1.8	1.4	1.6	1.6	1.7	1.7	1.9	2	2	2	2	2.3
Patella length	6.1	4.5	4.9	4.6	5.6	4.2	5.2	5.2	5	5	5	5.6
Patella width	2.3	1.9	2.1	1.8	2.1	2.1	2.6	2.8	2.6	2.8	2.5	2.9
Chela length	11.3	8.5	9.1	8.4	10.3	8.3	10	10.2	9.6	9.6	10.2	10.8
Chela manus width	2.4	2	2.3	2.2	2.3	2.7	3.3	3.6	3.1	3.1	3.6	3.8
Chela manus height	1.5	1.1	1.3	1.4	1.5	1.7	1.6	1.6	1.4	1.4	1.4	1.9
Chela movable finger length	4	3.2	3.8	3.4	3.9	3.5	4.1	4.2	4	4	4	4.6
Metasomal segment I length	1.6	1.3	1.4	1.3	1.4	1.1	1.6	1.3	1.4	1.3	1.4	1.6
Metasomal segment I width	1.1	0.9	0.63	0.9	1	1	1.1	1.1	1	1	1	1.2
Metasomal segment V length	2.6	2.1	2.4	2.1	2.6	2.1	2.8	2.4	2.6	2.4	2.6	2.8
Metasomal segment V width	0.7	0.6	0.6	0.6	0.6	0.7	0.8	0.8	0.7	0.7	0.7	0.8
Metasomal segment V height	0.9	0.8	0.9	0.7	0.9	0.8	0.9	1	0.9	1	0.9	1
Telson vesicle width	0.8	0.7	0.8	0.7	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.9
Telson vesicle height	0.8	0.7	0.7	0.7	0.8	0.8	0.9	0.8	0.8	0.8	0.8	0.9

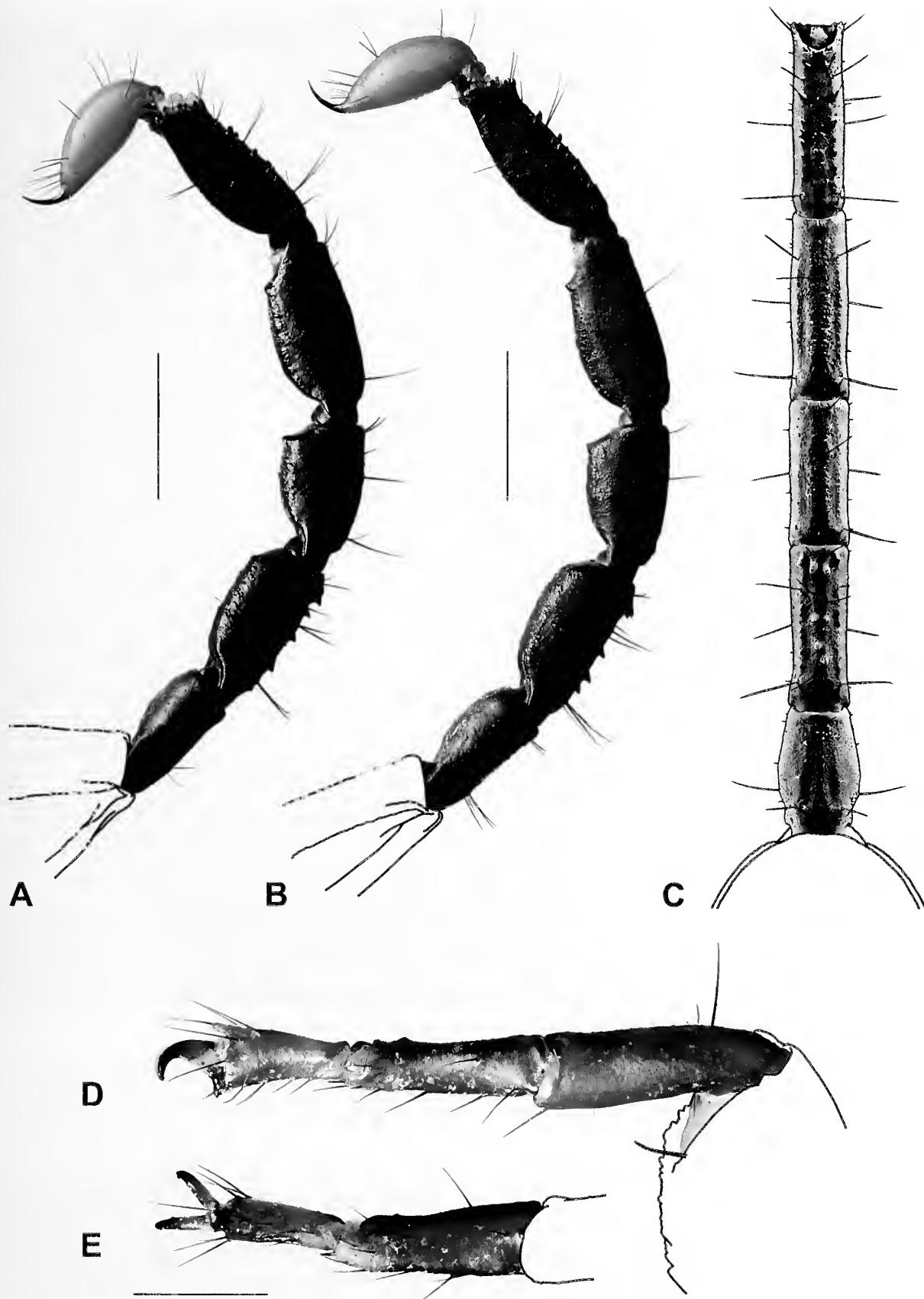


Fig. 23. *Hormiops infulcra* Monod, 2014, metasoma and telson, lateral (A-B) and ventral (C) aspects; left tarsus IV, retrolateral (D) and ventral (E) aspects. (A) Female paratype (MHNG, sample VMI-12/14). (B-E) Male holotype (MHNG, sample VMI-12/14). Scale, 2 mm (A-C), 1 mm (D-E).

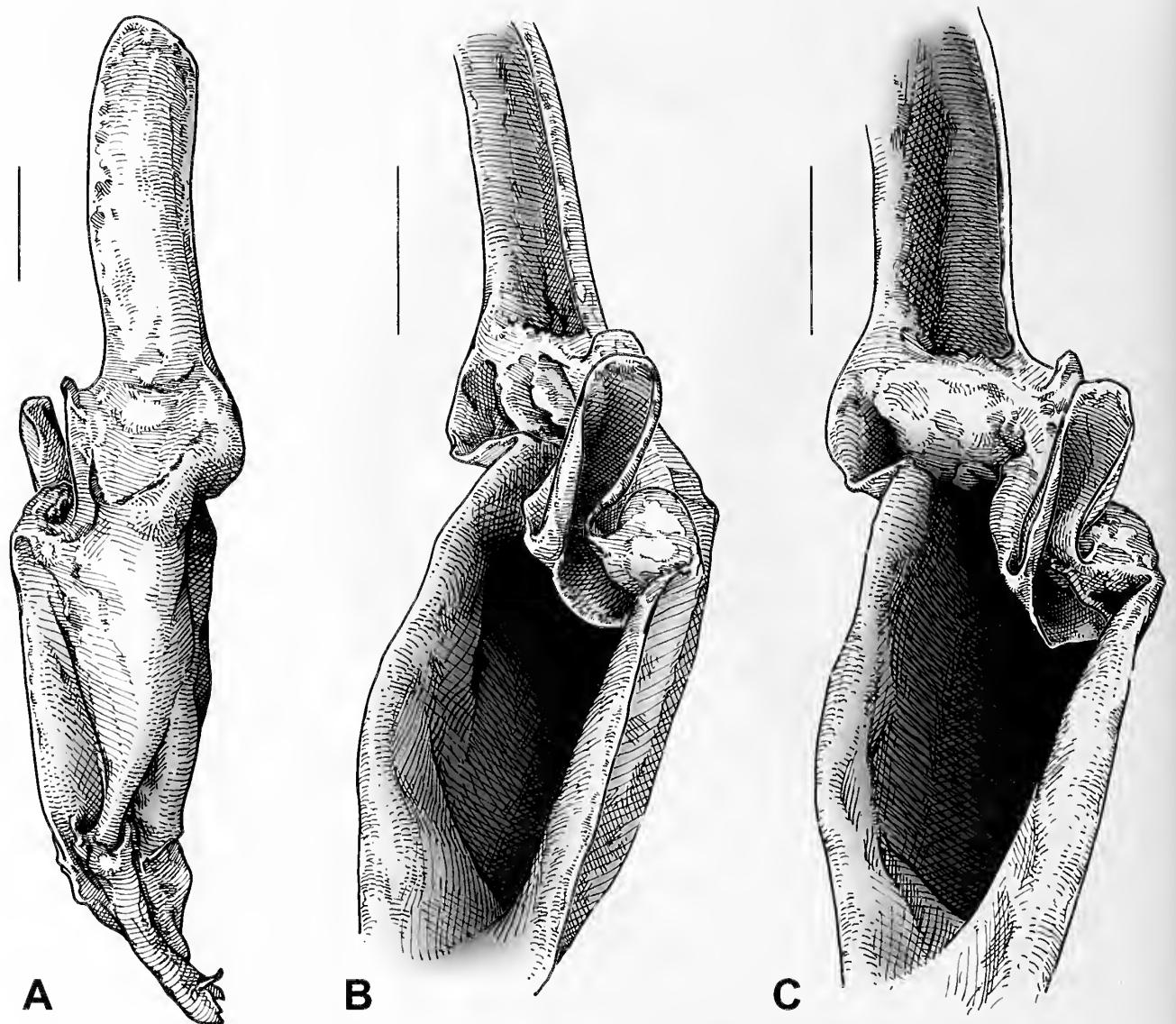


Fig. 24. *Hormiops infulcra* Monod, 2014, male holotype (MHNG, sample VMI-12/14), left hemispermatophore. (A) Dorsal aspect. (B-C) Detail of capsular region, ental (B) and ventral (C) aspects. Scale, 0.5 mm.

Book lungs: Lamellar surfaces with regularly spaced simple trabeculae, each with a knoblike tip (Fig. 26A-B); distal edges of lamellae covered with arcuate structures formed by fusion of bent cuticular processes (Fig. 26C-D); posterior edge of spiracle smooth, margin close to atrial wall with hillock-like structures (Fig. 26E-F).

Description of adult female: Same characters as in male except as follows.

Colouration: Pedipalps slightly darker than in males.

Pedipalps: All segments noticeably shorter and more robust than in male (Figs 1D, 17B, D, 19A, F, K). Prolateral process of patella angled approximately perpendicular to longitudinal axis of segment (Fig. 19F).

Carapace: Surface smooth except along posterior part of lateral margins and median longitudinal sulci, sparsely and finely granular (Fig. 18B, D).

Genital operculum: Oval to semi-oval, wider than long, approximately same width as sternum (Fig. 22C); opercular sclerites partly fused, median suture distinct; posterior notch present, at least weakly developed.

Pectines: Short, distal edge not reaching distal edge of coxa IV (Fig. 22C). Pectinal teeth count 5/5.

Mesosoma: Post-tergites: lateral transversal sulcus slightly deeper on III-VI than in male (Fig. 18B, F); intercarinal surfaces of I-III smooth, faintly granular laterally; intercarinal surfaces of IV-VII smooth with few minute granules scattered along lateral margins.

Metasoma: Intercarinal surfaces less granular than in males, almost smooth (Fig. 23A).

Sexual dimorphism: The pedipalps of males and females are strongly dimorphic (Figs 1B, D, 17, 19). They differ between the sexes not only in length

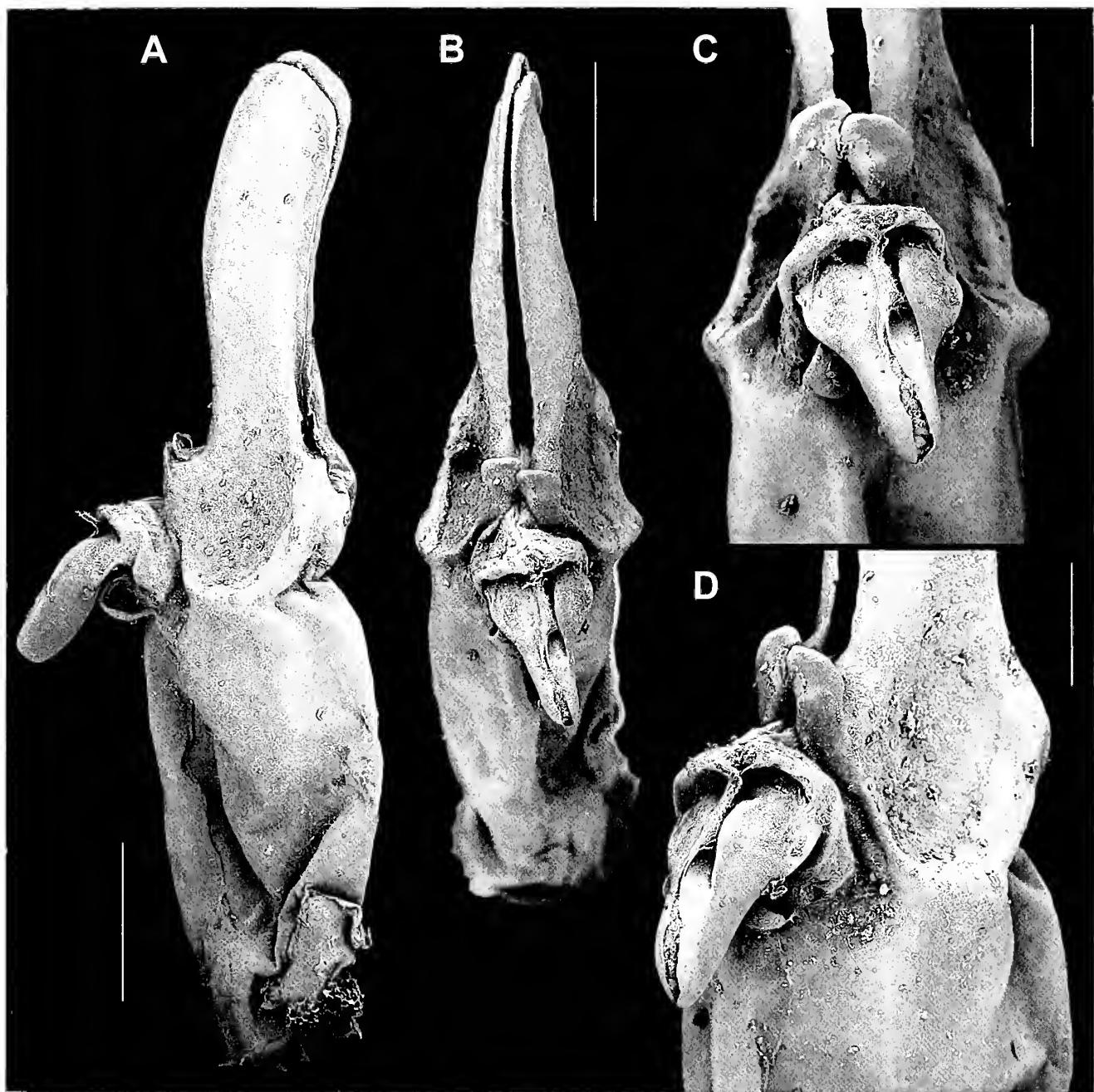


Fig. 25. *Hormiops infulcra* Monod, 2014, male holotype (MHNG, sample VMI-12/14), post-insemination spermatophore. In toto, lateral (A) and upper (B) aspects. Detail of capsular region, anterior aspect (C), rotated approximately 45° counter-clockwise from lateral aspect (D). Scales, 0.5 mm (A-B), 0.25 (C-D).

compared to body size, but also in allometric slopes (Fig. 13B; Ho : slopes are equal, likelihood ratio statistic: 6.735, P-value = 0.0094564). Pedipalps are positively allometric in males (slope = 1.33089; lower limit = 1.129663, upper limit = 1.567963; Ho : slope not different from 1, test statistic: r = 0.6046, P-value = 0.0013684), whereas in females they are isometric (slope = 0.9915464, lower limit = 0.8520906, upper limit = 1.1538258; Ho : slope not different from 1, test statistic: r = -0.02406, P-value = 0.90911).

Intraspecific variation: Large males have proportionally longer pedipalps than small males as indicated by the positive allometry (Fig. 13B). Pectinal teeth count varies from 5 to 7 in males (n = 25, mode = 6), and from 5 to 6 in females (n = 25, mode = 5).

Distribution and ecology: *Hormiops infulcra* is only known from two islands of the Seribuat Archipelago (Rompin District, Pahang State, Peninsular Malaysia) and is probably endemic to this group of granitic islands

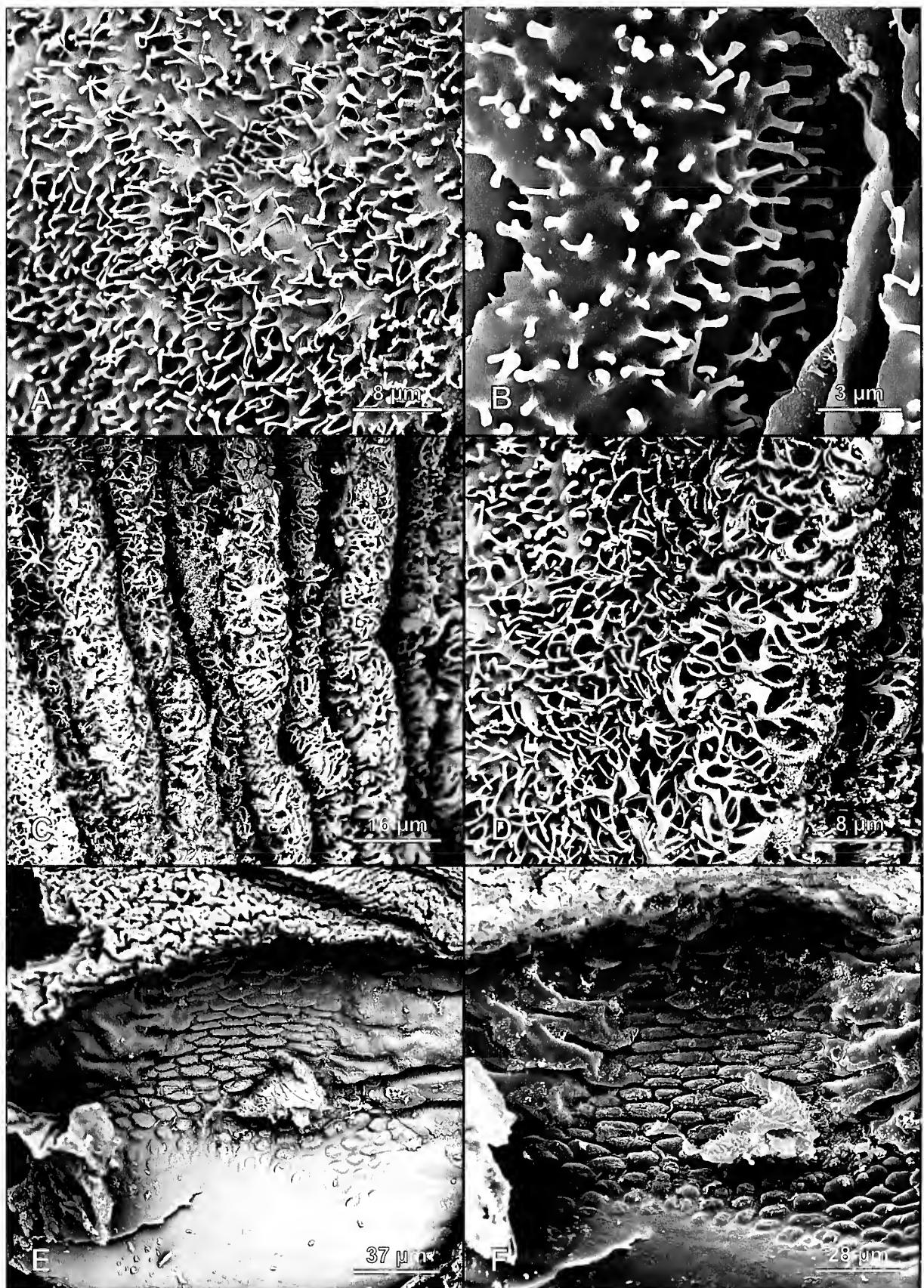


Fig. 26. *Hormiops infulcra* Monod, 2014, book lungs of male paratype (MHNG, sample VMI-12/14). (A-B) Surface of book lung lamella with simple trabeculae. (C-D) Arcuate distal edges of book lung lamellae, posterior view. (D-E) Movable posterior edge of spiracle with hillock-like and chisel-like structures (circle), anterior view.

(Fig. 27). On Pulau Tioman, scorpions were collected in primary rainforests, most of them in narrow crevices of granitic outcrops (Fig. 28). Although these scorpions are primarily stenotopic rock dwellers, a few specimens were found under the bark and in holes of fallen logs or standing trees. It is probable that these were seeking shelter on alternative substrate due to the high population densities of *H. infulcra* on Pulau Tioman and the limited quantity of crevices in granite. *Hormiops infulcra* was found in syntopy (*sensu* Rivas, 1964) with *L. australasiae*. Both species occupy the same microhabitats, i.e. rock crevices and tree holes, however *L. australasiae* was rarely found on rock but was more prevalent on trees. The habitat and habitus of *H. infulcra* are consistent with the lithophilous ecomorphotype (Prendini, 2000).

Conservation status: Most known populations of *H. infulcra* occur in protected rainforests of the Pulau Tioman Wildlife Reserve. The species can be categorized as a short-range endemic because the land area of the islands on which it is found represents about 133.6 km². Although *H. infulcra* is currently not threatened, its restricted distribution range makes the species particularly vulnerable to potential threats from tourism and loss of habitat in the future, and it is

recommended that it be placed in the IUCN Red List of near threatened species (International Union for the Conservation of Nature, 2001).

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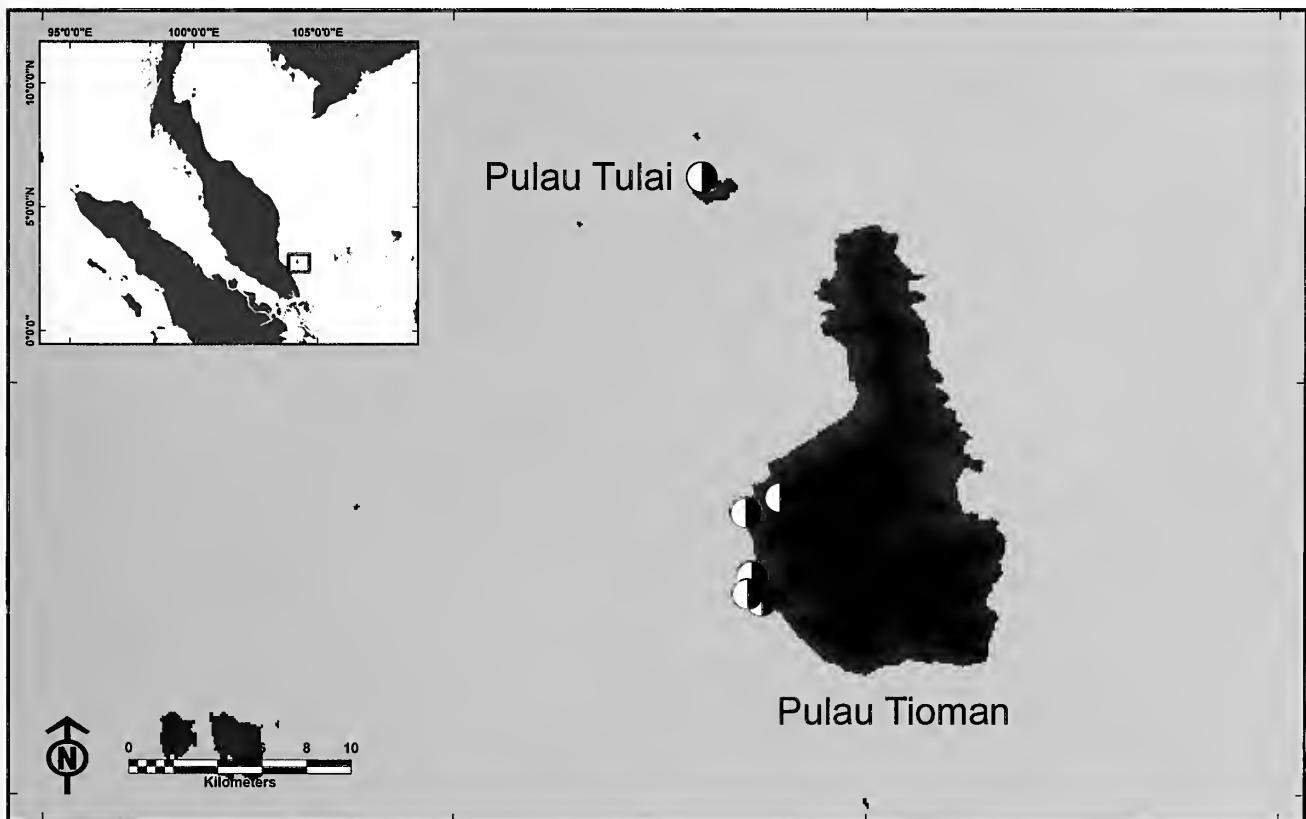


Fig. 27. Known localities of *Hormiops infulcra* Monod, 2014 in the Seribuat Archipelago, Pahang, Malaysia, with topography indicated.



Fig. 28. Two biotopes of *Hormiops infulcra* Monod, 2014 on Pulau Tioman, Seribuat Archipelago, Pahang, Malaysia.

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New and little known Epilamprinae (Dictyoptera: Blaberidae) from the collections of the Muséum d'histoire naturelle de Genève and the Zoological Institute of Saint Petersburg. Part 1

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Abstract: A new genus and species of cockroach, *Paracalolamprodes tioman* gen. et sp. nov., is described from Malaysia. Lectotypes of *Apsidopis cyclops* Saussure, 1895 and *Calolampra bolleyi* Saussure, 1895 are designated. A detailed morphological description of the new taxa, as well as a redescription of *A. cyclops*, *Aptera fusca* (Thunberg, 1784) and *Litopeltis bolleyi* (Saussure, 1895) are given.

Keywords: *Paracalolamprodes tioman* gen. et sp. nov. - *Apsidopis cyclops* - *Aptera fusca* - *Litopeltis bolleyi* - morphology.

INTRODUCTION

This work is the second in a planned series of papers devoted to dictyopterans in the collections of the Muséum d'histoire naturelle in Geneva.

The family Blaberidae Brunner von Wattenwyl, 1865 includes the most derived cockroaches. The most prominent characters of the family are the specialized type of oviposition – the ootheca incubated internally in the brood sac, and the derived type of the male genitalia – the sclerites form three main complexes lying separately in membranous sheaths. The subfamily Epilamprinae Brunner von Wattenwyl, 1865 is one of the most diverse of the family Blaberidae.

The lack of morphological studies, especially of the male and female genital structures, is the main impediment to a phylogenetic analysis of the Dictyoptera. The aim of this study is to provide morphological descriptions which are detailed enough for further phylogenetic investigations.

MATERIAL AND METHODS

The author follows the methods described in Anisyutkin (2014a, b). The studied specimens were dried and pinned. In order to study structures of the male and female genital complexes, the specimens were subjected to the standard procedures (Anisyutkin, 2014a, b). After investigation, the dissected parts are preserved in microvials (in 70% ethanol or in glycerol).

The author generally follows Rehn's (1951) interpretation of the venation of the tegmina and wings. Description of the anterior margin of fore femur armament follows

Bey-Bienko (1950) and Roth (2003). The terminology of male genital sclerites follows Klass (1997) with some modifications. The terminology used by Grandcolas (1996) for genital structures is given in parentheses following the author's designations. The terminology of the female genital structures follows McKittrick (1964) and Klass (1998). The terms introduced by the author (in the present work and in Anisyutkin, 2014a, b; Anisyutkin *et al.*, 2013) are given in quotation marks.

All material studied, including the holotype of the new species, has been deposited in the Muséum d'histoire naturelle of Geneva, Switzerland (MHNG) or the Zoological Institute, Russian Academy of Sciences in Saint-Petersburg, Russia (ZIN).

Abbreviations used in figures

(see text for further details):

1pl. - 1st plical vein of the wing (*sensu* Rehn, 1951).

3pl. - 3rd plical vein of the wing (*sensu* Rehn, 1951).

VIII, IX, X - 8th-10th abdominal tergites respectively.

a.s. - “additional spines” - spines bordering euplantulae from inside and outside.

a.a. - anterior arch of second valvifer of the female genitalia.

Ant.R.rami - area of anterior branches of radius vein.

ap.scl. - “apical sclerite” of the sclerite L2D in the male genitalia.

bsv. - basivalvula of the female genitalia.

CuA - area of cubitus anterior vein branches.

CuP - cubitus posterior vein (= plical furrow *sensu* Rehn, 1951).

c.p.R/T - caudal part of sclerite R1T of the male genitalia.

- a.L2D* - apical part of sclerite L2D of the male genitalia.
b.L2D - basal part of sclerite L2D of the male genitalia.
b.L3 - basal subsclerite of the sclerite L3 in the male genitalia.
b.o. - "bent outgrowth" of basal part of the sclerite L2D in the male genitalia.
d.o. - "dorsal outgrowth" of apical part of the sclerite L2D in the male genitalia.
e.r. - exterior row of spines along lower margin of hind metatarsus.
f.s. - "folded structure" of the sclerite L3 in the male genitalia.
gg. - gonangulum of the female genitalia.
hge. - groove of the sclerite L3 in the male genitalia (*sensu* Klass, 1997).
hl. - hollow on sclerite R2 in the male genitalia.
i.r. - interior row of spines along lower margin of hind metatarsus.
int.tr. - intercalated triangle of wing (*sensu* Rehn, 1951).
m.o. - "membranous outgrowth" of sclerite L3 of the male genitalia.
par. - paraproct.
pl. - sclerotized lobes of the 2nd and 3rd pairs of valves in the female genitalia.
R+M - area of radius and media veins branches.
R1T, R2, R3, R4, R5 - sclerites of the male genitalia.
r.plm. - right phallomere of the male genitalia.
L3, L4U, R1T, R2, R3, R4, R5 - sclerites of the male genitalia.
s.t. - "small tooth" of apical part of the sclerite L3 in the male genitalia.
str.a. - area of fine striations on "upper triangular lobe".
Sc - area of subcosta vein branches.
spi. - spinules located on metatarsal euplantula.
spr. - spiracle.
str. - striation on caudal part of sclerite R1T of the male genitalia.
teIX. - tergal process of the 9th abdominal tergite.
tr.l. - "upper triangular lobe" of right phallomere of the male genitalia.
v.I., v.II., v.III. - the 1st, 2nd and 3rd valves of ovipositor respectively.
vs. - vestibular sclerite in the female genitalia.

TAXONOMIC PART

Paracalolamprodes gen. nov.

Type species: *Paracalolamprodes tioman* sp. nov., designated here.

Differential diagnosis: The new genus differs from the vast majority of representatives of the subfamily Epilamprinae by a very characteristic structure of the tarsi: hind metatarsi with 2 unequal rows of spines along lower margin (Fig. 4). The single known epilamprine genus with a similar structure of

the tarsi is *Calolamprodes* Bey-Bienko, 1969. This genus includes 2 subgenera: *Calolamprodes* s. str. and *Brachycalolamprodes* Anisyutkin, 1999. Both subgenera are characterized with unequal rows of metatarsal spines and similar structure of the male genitalia (Bey-Bienko, 1969; Anisyutkin, 1999, 2006). *Paracalolamprodes* gen. nov. differs from *Calolamprodes* in strongly reduced tegmina in males (Fig. 2) and the structure of the male genitalia (compare Figs 8-15 of present paper, Figs 18-33 in Anisyutkin, 1999 and 15-41 in Anisyutkin, 2006): right phallomere (R+N) with caudal part of sclerite R1T more developed (Figs 9-10, *c.p.R1T*), R2 well sclerotized and distinctly curved, R3 more robust and shorter, R5 well sclerotized, closely associated with R2; sclerite L2D (L1) without outgrowths at caudal end of basal part (Figs 8, 11-12); sclerite L3 (L2d) caudally widely rounded, without developed "apieal crest" (Figs 13-15).

The genera *Calolamprodes* and *Paracalolamprodes* gen. nov. are probably closely related. The possible synapomorphies are the structure of the tarsi (presence of unequal rows of metatarsal spines) and the male genital sclerites (caudal part of sclerite R1T weak, as compared with those structures of *Morphna* sp. and *Rhabdoblatta* sp. - Anisyutkin, 2014b, sclerite R4 partly membranous, fused with caudal part of sclerite R1T, apical part of sclerite L2D (L1) plate-like). It must be noted that structure of the right phallomere of *Paracalolamprodes* gen. nov. seems to be less advanced than that of *Calolamprodes*. The moderately developed caudal part of sclerite R1T, curved R2, and comparatively robust R3 are more similar to the general type of right phallomere in the Epilamprinae, than to the same structures in *Calolamprodes*.

Calolamprodes (*Brachycalolamprodes*) *gorochovi* Anisyutkin, 1999, the single known representative of the subgenus *Brachycalolamprodes* Anisyutkin, 1999, is characterized by shortened (only reaching 2nd abdominal tergite) and strongly sclerotized tegmina (Anisyutkin, 1999; 2006). The shortening of the tegmina and wings in *Paracalolamprodes* gen. nov. and *Brachycalolamprodes* is evidently convergent because of the clearly different structure of the male genitalia and the rather usual reduction of the tegmina and wings compared to other cockroaches (Bell *et al.*, 2007).

A similar structure of the tarsi, *i.e.* presence of two unequal rows of spines along lower margin of tarsal articles, was mentioned for representatives of *Macrostylopyga* Anisyutkin, Anichkin & Nguyen, 2013 and *Afrostylopyga* Anisyutkin, 2014 in Blattidae (Blattinae) (Anisyutkin *et al.*, 2013; Anisyutkin, 2014a). The similarity in these cases is undoubtedly due to convergence.

Included species: The type species only.

Etymology: The name means "cockroach distinct from, but analogous to *Calolamprodes*".

Paracalolamprodes tioman sp. nov.

Figs 1-15

Material examined: Holotype; MHNG; male; W. Malaysia, Tioman Island, above Japamala Resort ($2^{\circ}44'42.7''N$, $104^{\circ}07'27.7''E$), 117 m, rainforest, sifting, 23-27.01.2012, leg. L. Monod. VMI-12/16.

Description of male (holotype): General colour dark reddish-brown. Epicranium (with exception of ocellar spots) and eyes black. Pronotum, tegmina, thoracal and abdominal tergites dark brown, reddish along with sides. Head with pale ocellar spots and yellow distal halves of clypeus and labrum. Antennae yellowish at base, darker (reddish-brown) towards apex. Maxillary palps pale. Thorax from below brown with indistinct yellow maculae. Abdominal sternites reddish brown with indistinct lighter (reddish) median stripe. Coxae reddish-brown; rest of legs, with exception of yellow tarsi, reddish. Cerci partly pale yellow. Surfaces smooth. Body from below, head and coxae with very weak punctuation. Head as in Fig. 1; distance between eyes 1.3 times eye length; distance between antennal sockets 2 times scape length; approximate length ratio of 3rd-5th segments of maxillary palps 1 : 1 : 1.1. Pronotum campaniform, marginated, with anterior and lateral margins semicircular, posterior - nearly straight, postero-caudal angles weakly attenuate caudally (Fig. 2); meso- and metanotum with caudal margins straight (Fig. 2); metanotum with lateral margins rounded and postero-caudal angles attenuated caudally (Fig. 2). Tegmina strongly reduced (Fig. 2); wings vestigial. Anterior margin of fore femur armed as in the type B (*sensu* Bey-Bienko, 1950; Roth, 2003), with 5 spines, including 2 apical ones. Fore tibiae weakly thickened distally (Fig. 3). Structure of hind tarsi: metatarsus longer than other tarsal segments combined, with two unequal rows of spines along lower margin [exterior row (Fig. 4, e.r.) consists of 19-20, interior one (Fig. 4, i.r.) 22 spines]; 2nd and 3rd segment with 5-6/4-5 and 1-2/2 spines in exterior/interior rows respectively; metatarsus and 2nd-4th segments with apical euplantulae and 1-2 additional spines bordering euplantulae (Fig. 4, a.s.); claws symmetrical and simple; arolium present, about as long as half of claw length. Abdominal tergites without visible glandular specializations. Anal plate (X, ultimate tergite) widely rounded, with weak medial emargination (Figs 5-6). Paraprocts of blaberid-type, as in Fig. 6. Hypandrium asymmetrical, as in Figs 7, 8; styli cylindrical, right one basally curved.

Genitalia (Figs 8-15): Right phallomere (R+N): sclerite R1T well sclerotized, with moderately developed caudal part (Figs 9-10, c.p.R/T), densely covered with bristles; R2 distinctly curved and well sclerotized; R3 elongated, but not rod-like, forked caudally; R4 substituted with membranous lobe, fused with caudal part of sclerite R1T; R5 well sclerotized, closely associated with R2, not contacted with R3. Sclerite L2D (L1) divided into

basal and apical parts (Figs 8, 11-12); basal part strongly widened cranially, without any outgrowths (Fig. 8, b.L2D); apical part in shape of flattened sclerite, without additional sclerites (Figs 11-12, a.L2D); bristles absent. Sclerite L3 (L2d) without basal subsclerite, "folded structure" and bristles (Figs 13-15); apex of L3 with attenuated "small tooth" (Figs 13-15, s.t.); "apical crest" and groove *hge* absent. Sclerite L4U (L3d) weakly sclerotized, elongated (Fig. 8).

Females: unknown.

Measurements (in mm): Head length 2.6, head width 2.7; pronotum length 3.6, pronotum width 6.1; tegmen length 2.4, tegmen width 3.1.

Comparison: As given for the genus.

Apsidopis Saussure, 1895

Type species: *Apsidopis cyclops* Saussure, 1895, by monotypy.

Remarks: This genus was initially monotypical comprising only the species *A. cyclops* Saussure, 1895. *Apsidopis cyclops* was described from an unspecified number of males from "Borneo meridionalis" (Saussure, 1895). Later two species were added to the genus: *Epilampra oxyptera* Walker, 1868 and *A. wallacei* Shelford, 1907 (Shelford, 1910; Hanitsch, 1915; Bruijning, 1948). Both species were described based on material from Borneo, Sarawak.

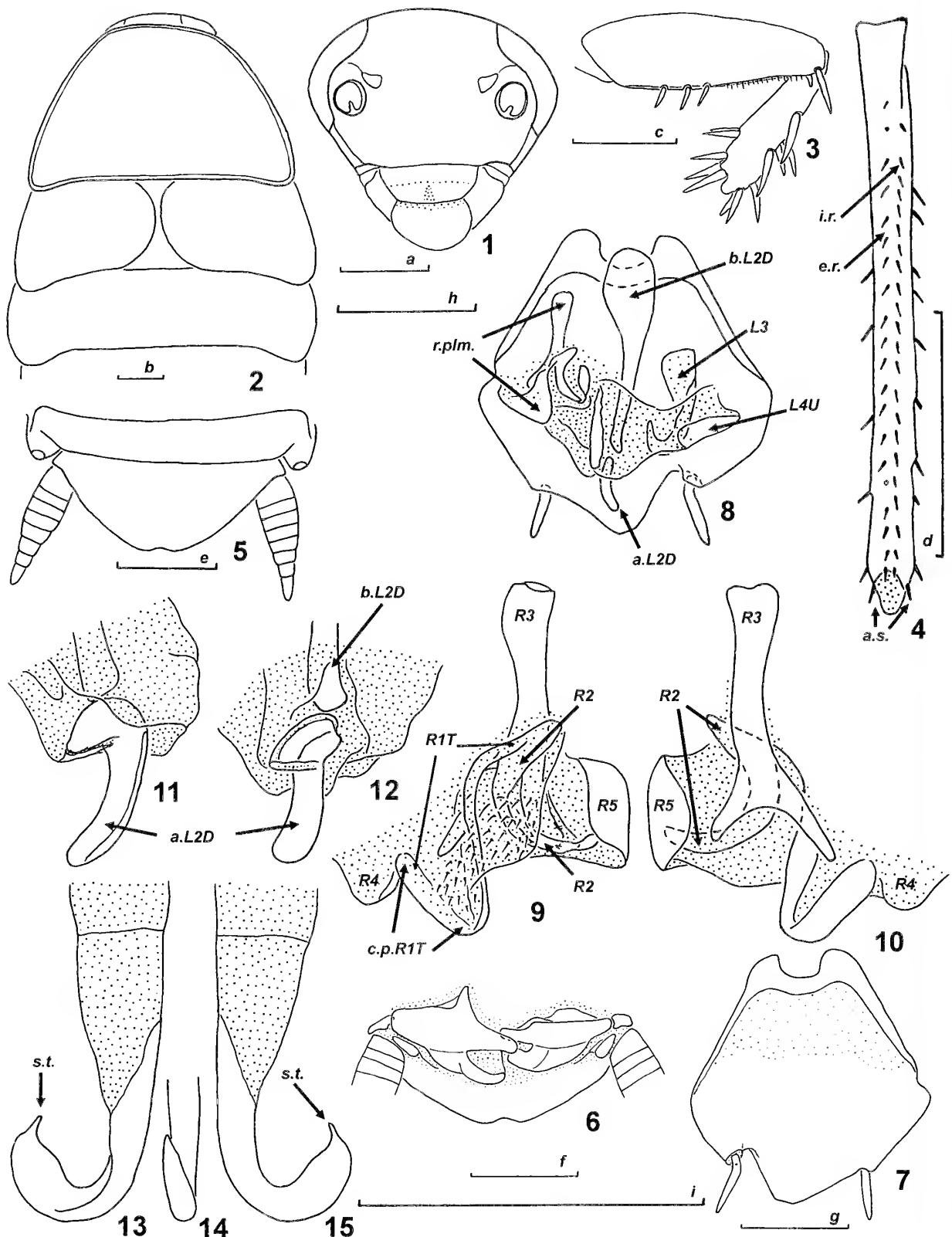
Apsidopsis cyclops was synonymized with *A. oxyptera* by Princis (1958: 65) as follows: "Walkers *oxyptera* (♀) und Saussures *cyclops* (♂) sind lediglich die beiden Geschlechter ein und derselben Art". It must be noted that the type of *A. oxyptera* was identified as a male in the original description (Walker, 1868: 199) and Hanitsch wrote: "This species [*A. oxyptera* - L.A.] seems to be known by three specimens only, viz. by the type, ♂, collected by Wallace in Sarawak and now in the British Museum; by a ♀ from Kuching, Sarawak, presented by R. Shelford to the Oxford Museum in 1900; and by a ♀ which I took on Bukit Timah, Singapore, July 1911" (Hanitsch, 1923: 424).

Apsidopis cyclops differs from the insufficiently described *A. oxyptera* in the more dark colouration, the transverse pronotum, and the longer and narrower costal field of the tegmina (compare Figs 17, 50-51, 60 and plate 1 fig. 5 in Shelford, 1910). Taking this into account, it is safe to consider *A. cyclops* a valid species.

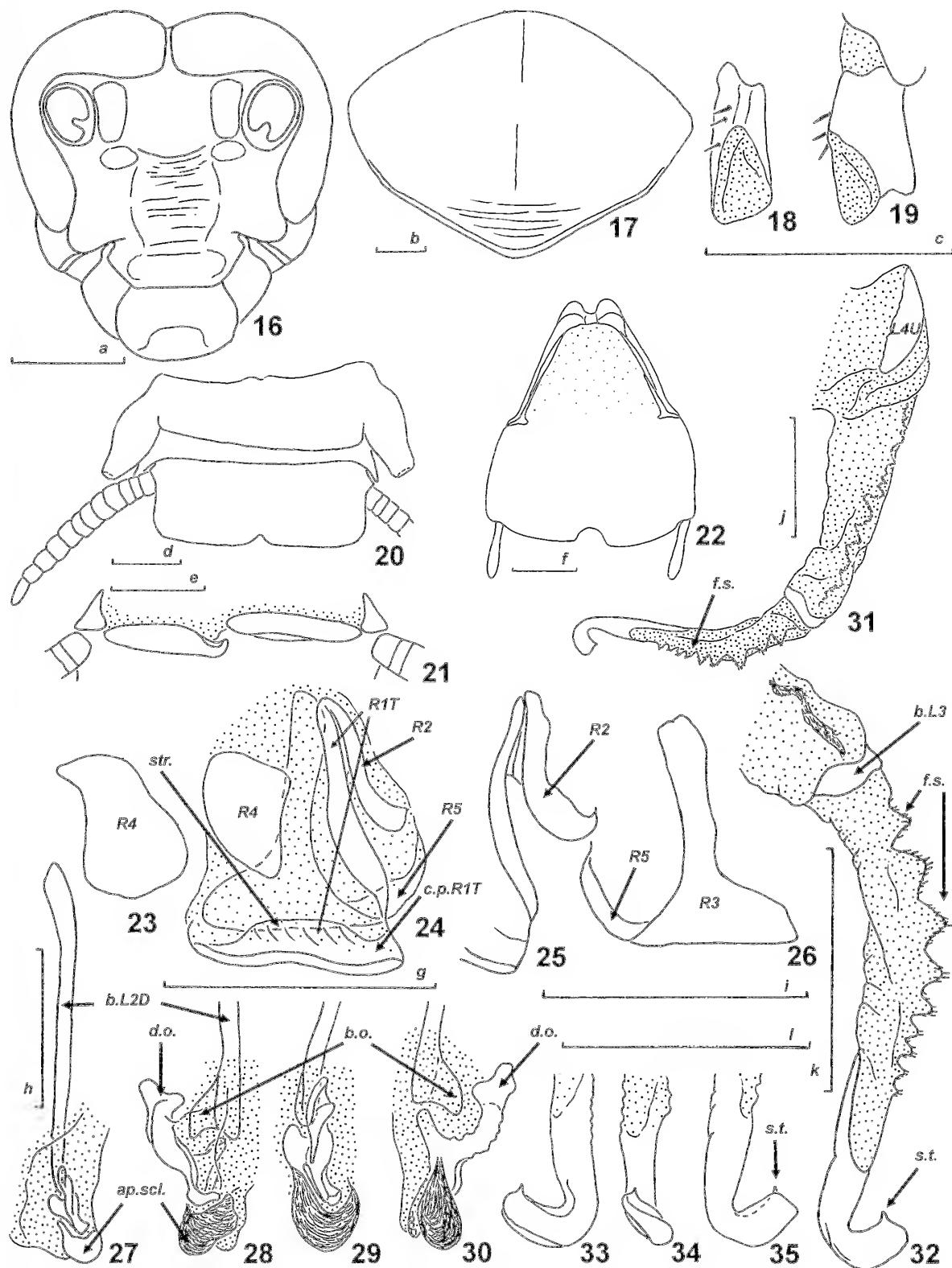
Apsidopis cyclops Saussure, 1895

Figs 16-35, 50-51, 60-61

Material examined: MHNG, ♂ lectotype, designated herewith; Borneo Is., "Epilampra cyclops ♂", "Sud Borneo", genital complex in prep. 150714/01.



Figs 1-15. *Paracalolamprodes tioman* gen. et sp. nov. (1) Facial part of head. (2) Head and thorax, dorsal view. (3) Fore tibia and femur seen from anterior. (4) Hind metatarsus, ventral view. (5) Abdominal apex, dorsal view. (6) Abdominal apex with hypandrium and genitalia removed, ventral view. (7) Hypandrium, ventral view. (8) Hypandrium and genitalia, dorsal view. (9) Right phallomere, dorsal view. (10) The same, ventral view. (11) Caudal part of sclerite L2D, seen from outside. (12) The same, dorsal view. (13, 15) Sclerite L3. (14) Apex of sclerite L3. Dotted areas show membranous parts. Abbreviations: a.L2D, a.s., b.L2D, c.p.R1T, e.r., i.r., L3, L4U, r.plm., R1T, R2, R3, R4, R5, s.t. - see chapter “abbreviation used in figures”, for details see text. Scale bars 1 mm: a = 1, b = 2, c = 3, d = 4, e = 5, f = 6, g = 7, h = 8, i = 9-15.



Figs 16-35. *Apsidopis cyclops* Saussure, 1895. (16) Facial part of head. (17) Pronotum, dorsal view. (18) Middle left metatarsus, ventral view. (19) The same seen from anterior. (20) Abdominal apex, dorsal view. (21) Paraprocts, ventral view. (22) Hypandrium, ventral view. (23) Sclerite R4, dorsal view. (24) Right phallomere, dorsal view. (25) Sclerites R1T (partly) and R2, seen from inside. (26) Sclerites R3 and R5, ventral view. (27) Sclerite L2d, dorsal view. (28, 30) Caudal part of sclerite L2D, seen from outside. (29) The same, dorsal view. (31) Sclerites L3 and L4U. (32) Apical part of sclerite L3. (33-35) Apex of sclerite L3. Dotted areas show membranous parts. Abbreviations: *ap.scl.*, *b.L2D*, *b.L3*, *b.o.*, *c.p.R1T*, *d.o.*, *f.s.*, *L4U*, *R1T*, *R2*, *R3*, *R4*, *R5*, *s.t.*, *str.* - see chapter "abbreviation used in figures", for details see text. Scale bars 1 mm: *a* = 16, *b* = 17, *c* = 18, 19, *d* = 20, *e* = 21, *f* = 22, *g* = 23-26, *h* = 27, *i* = 28-30, *j* = 31, *k* = 32, *l* = 33-35.

Redescription of male (holotype): General colour yellowish, eyes black, antennae and caudal part of pronotum brownish (Fig. 50). Surfaces lustrous; pronotum and tegmina in proximal half distinctly punctured. Head longer than wide (Fig. 16); ocellar spots large; facial part with distinct impressions between eyes and weak transverse wrinkles below impression; eyes large, nearly contiguous at vertex; distance between antennal sockets about 1.2 times the scape length (1.0 mm); approximate length ratio of 3rd-5th segments of maxillary palps 1.0 : 1.2 : 1.3. Pronotum as in Figs 17 and 50-51. Tegmina and wings completely developed, surpassing abdominal apex (Figs 50-51). Tegmina with weakly attenuate apex (Fig. 60); sclerotized in proximal half (especially in costal and anal fields), rest part membranous; venation distinct; costal field wide and short; *Sc* thickened (well visible on ventral side of tegmen); *R* and *M* stems not separated; *CuP* distinct. Wings mostly membranous, only with weakly sclerotized area of anterior rami of *R* (Fig. 61, *Ant.R.rami*); *Sc* long and simple; *RA* long, with anterior veins (Fig. 61, *Ant.R.rami*); *RS* distinct; *M* long and simple; *CuA* pectinate with 4 complete (reaching to wing margin) veins; behind *CuA* situated long and simple vein (Fig. 61, *1pl.*), probably corresponding to 1st plical vein *sensu* Rehn (1951) or *CuP* [probably *CuP* + *A1* *sensu* Bey-Bienko (1950)]; next long and simple vein proximally incrassated, probably corresponding to 3rd plical vein *sensu* Rehn (1951) (Fig. 61, *3pl.*); between 1st and 3rd plical veins a short reduced vein, probably corresponding to 2nd plical vein *sensu* Rehn (1951); anal fan consisting of 12-13 veins reaching margin of wing; 1-2 possibly jugal veins situated behind anal fan. Fore tibiae not thickened distally. Anterior margin of fore femora armed type B (*sensu* Bey-Bienko, 1950; Roth, 2003), with 3 spines, including 1 apical one. Tibial spines well developed. Hind tibiae in the studied specimens broken off; only left metatarsus present on middle legs. Middle metatarsus short, with large euplantula and 3 laterally displaced spines along lower margin (Figs 18-19). Fore tarsi with claws symmetrical and simple; arolium large, slightly shorter than claw length. Abdomen without visible glandular specializations. Anal plate (tergite X) nearly rectangular, caudal margin with small medial incision (Fig. 20). Cerci with distinct segments (Fig. 20). Paraprocts of blaberid-type (Fig. 21). Hypandrium symmetrical, caudal margin with large median incision; styli slightly flattened and widened distally (Fig. 22).

Genitalia (Figs 23-35): Right phallomere (*R+N*): sclerite R1T well sclerotized, caudal part weakly sinuate caudally, with striations (Fig. 24, *str.*); R2 slightly rounded (Figs 24-25); R3 elongated, subtriangular (Figs 24, 26); R4 large, plate-like (Figs 23-24); R5 small, closely associated with R3 (Fig. 26). Sclerite L2D (*L1*) divided into basal and apical parts (Figs 27-30); basal part rod-like, with “bent outgrowth” at caudal end (Figs 28,

30, *b.o.*); “apical sclerite” cap-like, rounded, densely covered with recumbent bristles (Figs 27-30, *ap.scl.*); “dorsal outgrowth” large and crest-like, directed cranially (Figs 27-30, *d.o.*). Sclerite L3 (*L2d*) with distinct basal subsclerite (Fig. 32, *b.L3*), “folded structure” and bristles (Figs 31-32, *f.s.*); apex of L3 with attenuated “small tooth” (Figs 31-35, *s.t.*); “apical crest” and groove *hge* absent. Sclerite L4U (*L3d*) distinct, plate-like (Fig. 31).

Measurements (in mm): Head length 2.9, head width 2.6; pronotum length 6.0, pronotum width 8.4; tegmen length 19.5, tegmen width 6.8.

Note: *Apsidopis cyclops* is similar to representatives of the genus *Pseudophoraspis* Kirby in structure of the head (presence of a distinct impression between the eyes – compare Fig. 16 and figs 79, 84-85, 87-90 in Anisyutkin, 1999) and the male genitalia (shape of “apical sclerite” and strongly developed “dorsal outgrowth” of sclerite L2D – compare Figs 27-30 and figs 106-107, 111-112, 123-124, 130-131, 139-145 in Anisyutkin, 1999).

Aptera Saussure, 1864

Type species: *Blatta fusca* Thunberg, 1784.

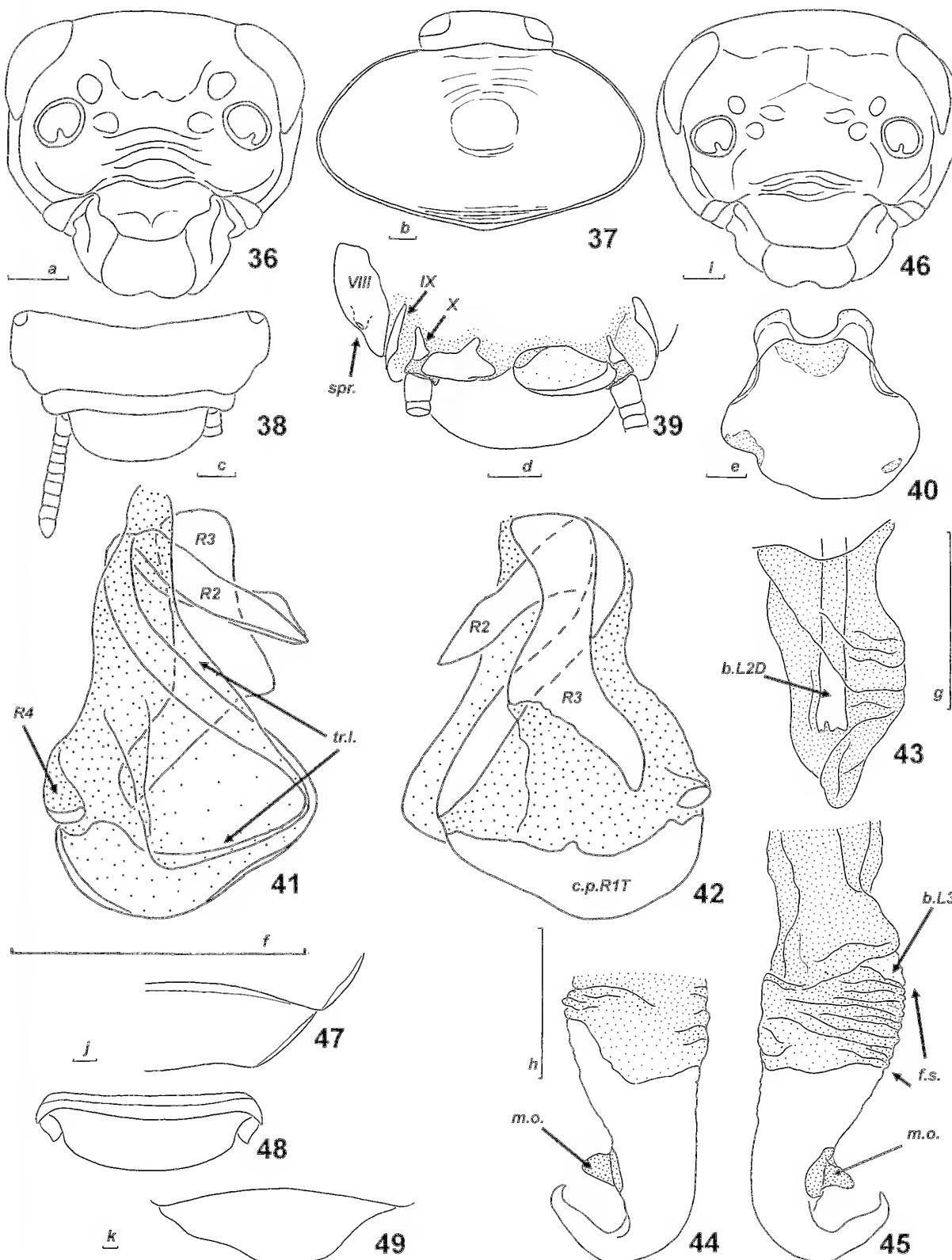
Remarks: This genus was initially monotypical including only *A. lenticularis* Saussure, 1864. Later, the genus *Oncerocorypha* Stål, 1871 was described for the single species *Perisphaeria cingulata* Burmeister, 1838. *Aptera lenticulata* was synonymized with *A. cingulata* and the genus *Oncerocorypha* with *Aptera* by Saussure & Zehntner (1895). *Aptera cingulata* was synonymized with *A. fusca* by Prineis (1963). At the present time, the genus *Aptera* includes two species, *A. fusca* and *A. munda* (Walker, 1868) (Beccaloni, 2007).

Aptera fusca (Thunberg, 1784)

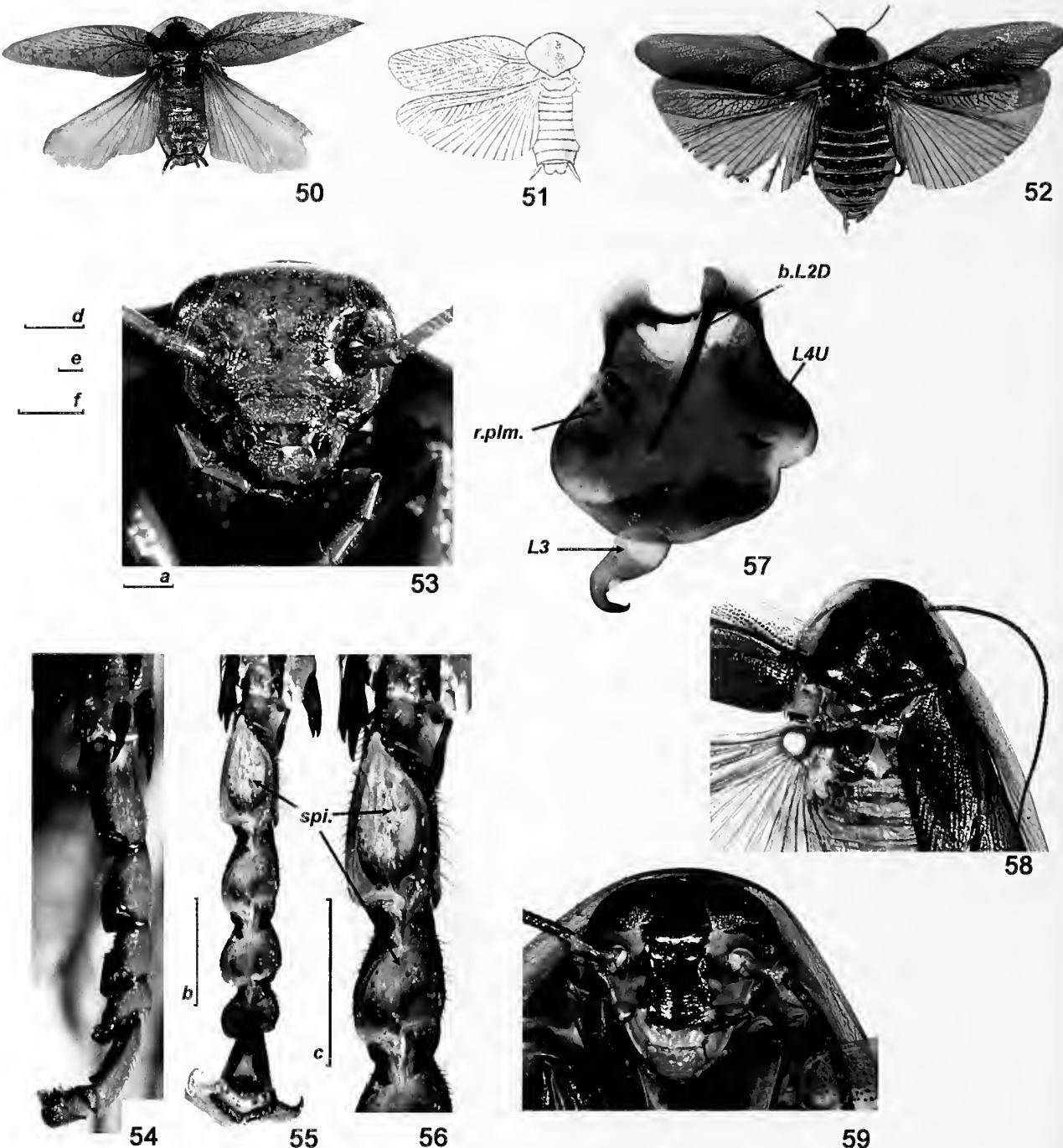
Figs 36-49, 52-57, 62-63

Material examined: MHNG; 1 ♂; “620 73 Africa or Mr. Brady”, “Afrq. austr. Brady.”, genital complex in prep. 150714/02. – ZIN; 1 ♀; 620 73 Africa or Mr. Brady”, “Afriq.austr by Brady”, “No 131-97.”, “*Aptera cingulata* ♀ Burm”, “Saussure det.”. – ZIN; 1 larva; “*Oncerocorypha cingulata* Burm. Cap. d. g. H”, “Brunner v. W. det.”.

Redescription of male: General colour brownish, partly black (Figs 52-57); facial part of head reddish (Fig. 53); eyes black; antennae and mouthpart yellowish; pronotum blackish in central part, lateral part yellow; tegmina reddish-brown; meso-, metathorax, coxae and most part of abdomen blackish; femora reddish-brown; tibiae and tarsi yellowish; abdominal tergites bordered with yellow along posterior and lateral sides; abdominal sternites black, bordered with yellow along



Figs 36-49. *Aptera cingulata* (Burmeister, 1838), male (36-45) and female (46-49). (36, 46) Facial part of head. (37) Head and pronotum, dorsal view. (38, 48) Abdominal apex, dorsal view. (39) The same, ventral view, hypandrium and the male genitalia removed. (40) Hypandrium, ventral view. (41) Right phallomere, dorsal view. (42) The same, ventral view. (43) Caudal part of sclerite L2D, dorsal view. (44, 45) Apical part of sclerite L3. (47) Lateral parts of abdominal tergites 7 and 8, dorsal view. (49) Genital plate, ventral view. Dotted areas show membranous parts. Abbreviations: IX, X, b.L2D, b.L3, c.p.R1T, f.s., m.o., R2, R3, R4, tr.l. - see chapter "abbreviation used in figures", for details see text. Scale bars 1 mm: a = 36, b = 37, c = 38, d = 39, e = 40, f = 41, 42, g = 43, h = 44, 45, i = 46, j = 47, 48, k = 49.



Figs 50-59. *Apsidopis cyclops* Saussure, 1895 (50-51), *Aptera cingulata* (Burmeister, 1838) (52-57), and *Litopeltis biolleyi* (Saussure, 1895) (58-59). (50-52) Habitus (wingspan: 50 = 46 mm; 52 = 64 mm). (53, 59) Head from below. (54) Left hind tarsus seen from anterior. (55) The same, ventral view. (56) 1st and 2nd tarsal segments, ventral view. (57) Hypandrium and genitalia, dorsal view. (58) Anterior part of body, dorsal view. Fig. 51 after Saussure, 1895. Abbreviations: *b.L2D*, *L3*, *L4U*, *r.plm.*, *spi.* - see chapter "abbreviation used in figures", for details see text. Fig. 51 not to scale. Scale bars 1 mm: a = 53, b = 54-55, c = 56, d = 57, e = 58, f = 59.

lateral sides. Surfaces smooth and lustrous, distal parts of antennae (approximately from 9-10th segments) dull; punctuation present in facial part of head, pronotum and proximal parts of tegmina; facial part of head rugose, with transverse wrinkles above clypeus. Head about as long as wide (Figs 36, 53); ocellar spots

small; faeial part with weak impressions between eyes; distance between eyes 1.4 times eye length; distance between antennal sockets 1.8 times of the scape length (1.2 mm); approximate length ratio of 3rd-5th segments of maxillary palps 1.1 : 1.0 : 1.1. Pronotum transverse (Figs 37, 52); lateral carinae on ventral side

absent. Tegmina and wings completely developed, surpassed abdominal apex (Fig. 52). Tegmina with rounded apex (Figs 52, 62); coriaceous, membranous in distal half; venation distinct, reticulate, sometimes irregular; costal field long and narrow; *Sc* thickened (well visible on ventral side of tegmen), fused with *R*; *R*, *M* and *CuA* stems separated; *CuP* distinct. Wings mostly membranous, only with weakly sclerotized area of anterior rami of *R* (Fig. 63, *Ant.R.rami*); intercalated triangle distinct (Fig. 63, *int.tr.*); *Sc* long and simple; *RA* long, with anterior veins (Fig. 63, *Ant.R.rami*); *RS* distinct; *M* long and simple; *CuA* pectinate with 2 or 3 complete (reaching to wing margin) veins; behind *CuA* situated long and simple, distinct only in basal half vein, bordered anteriorly intercalated triangle (Fig. 63, *lpl.*), probably corresponding to 1st plical vein *sensu* Rehn (1951) or *CuP* [probably *CuP* + *A1* *sensu* Bey-Bienko (1950)]; next long and simple vein bordered posteriorly intercalated triangle, probably correspond to 3rd plical vein *sensu* Rehn (1951) (Fig. 63, *3pl.*); these veins fused and incrassated basally; anal fan consisting of 8-9 veins reaching margin of wing; 3 possibly jugal veins situated behind anal fan. Anterior margin of fore femora armed according to the type C (*sensu* Bey-Bienko, 1950; Roth, 2003), with single apical spine. Fore tibiae not thickened distally. Tibial spines weak. Structure of hind tarsi: metatarsus distinctly shorter than other segments combined, with euplantula large, more than 3/4 of segment length (Figs 54-56); euplantulae of 2nd-4th segments large; euplantulae of 1st-4th segments with small, irregularly placed spinules (Figs 55-56, *spi.*); spines along lower margins of tarsal segments absent; claws symmetrical, simple; arolium large. Abdomen without visible glandular speacializations; spiracle-bearing outgrowths of tergite VIII weakly expressed (Figs 38-39), spiracles displaced from outgrowths apices (Fig. 39, *spr.*). Anal plate (tergite X) nearly rectangular, caudal margin nearly straight (Fig. 38). Cerci with distinct segments (Fig. 38). Paraprocts of blaberid-type (Fig. 39). Hypandrium asymmetrical, caudally rounded; styli absent (Figs 40, 57).

Genitalia (Figs 41-45, 57): Right phallomere (*R+N*): sclerite R1T well sclerotized, with caudal part rounded caudally (Figs 41-42, *c.p.R1T*), covered with “upper triangular lobe” (Fig. 41, *tr.l.*); “upper triangular lobe” covered with bristles (not shown in Fig. 41); R2 short and nearly straight; R3 short and triangular; R4 small, closely associated with caudal part of R1T; R5 absent. Sclerite L2D (*L1*) not divided into basal and apical parts (Fig. 57), widened cranially; “apical sclerite” absent, membranous lobe surrounding caudal part of L2D without bristles or sclerites (Figs 43, 57). Sclerite L3 (*L2d*) with distinct basal subsclerite (Fig. 45, *b.L3*), “folded structure” weak (Figs 44-45, *f.s.*), with “membranous outgrowth” opposite to hook (Figs 44-45, *m.o.*); apex of L3 with attenuated apex; “apeial crest” and groove *hge* absent. Sclerite L4U (*L3d*) distinct, triangular in shape (Fig. 57).

Redescription of female: Body ovoid and convex; completely apterous. Head transverse, eyes and ocellar spots smaller compared to male (Fig. 46); distance between eyes 1.8 times eye length; distance between antennal sockets 2.3 times of the scape length (1.5 mm); maxillary palps in the studied specimen broken off. Abdominal tergites without row of orifices along furrow at anterior margin (Fig. 47). Anal plate (tergite X) transverse, caudal margin widely rounded (Fig. 48). Cerci strongly shortend, one-segmented, traces of segmentation visible only on ventral side (Fig. 48). Genital plate caudally projected (Fig. 49).

The structures of the female genitalia of the specimen studied are lost because they were eviscerated before being mounted.

Redescription of larva: Similar to female, but smaller in size and head more globular. Fore tibiae not thickened distally.

Measurements (in mm): Head length: male 4.7, female 6.5; head width: male 4.7, female 7.2; pronotum length: male 6.2, female 9.3; pronotum width: male 11.2, female 16.5; tegmen length: male 23.3; tegmen width: male 8.6.

Litopeltis Hebard, 1920

Type species: *Calolampra bispinosa* Saussure, 1893, by monotypy.

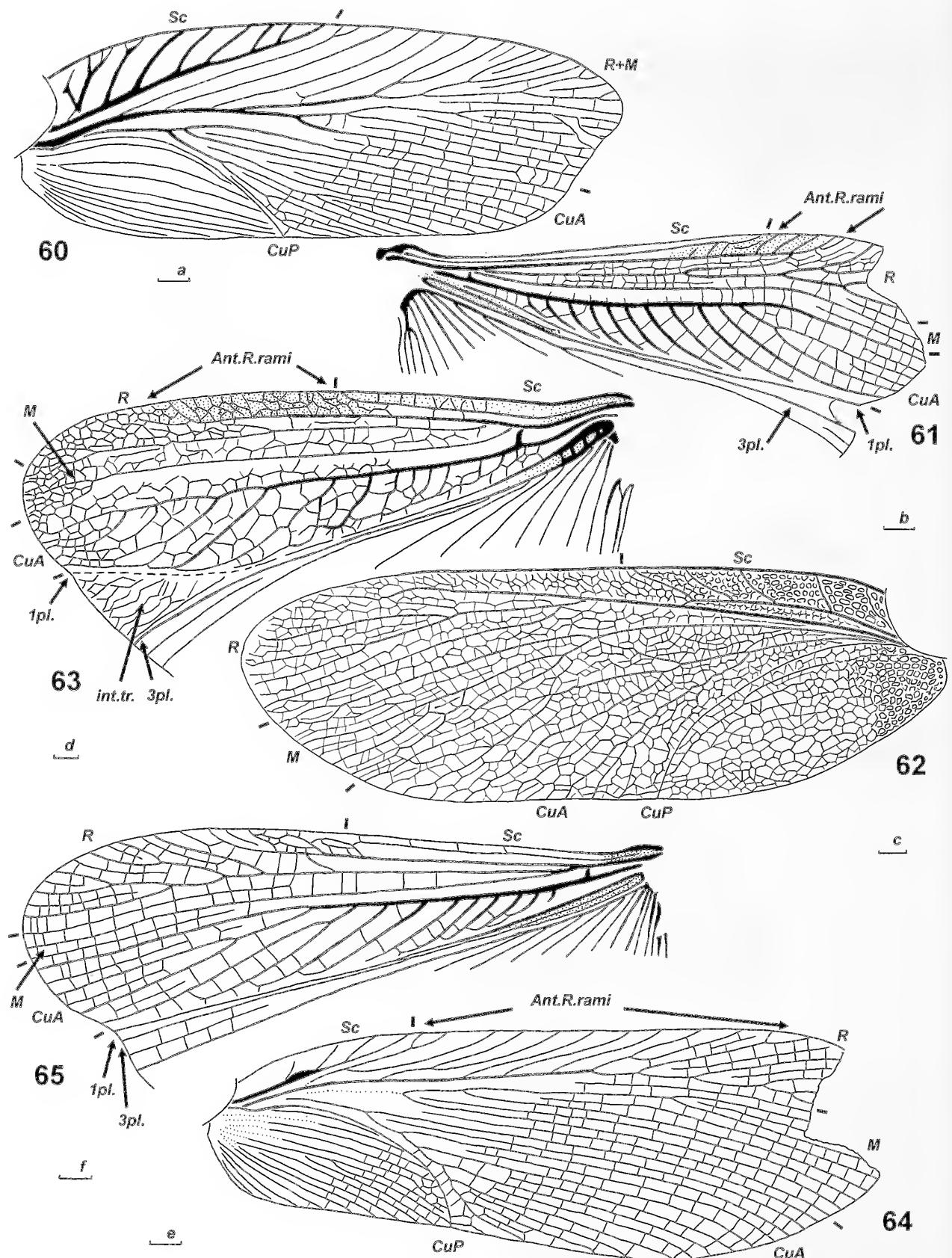
Remarks: The genus *Litopeltis* was recently discussed by Oliveira & Lopes (2014). *Litopeltis biolleyi* (Saussure, 1895) was described in the genus *Calolampra* Saussure, 1893 and transferred to *Litopeltis* by J.A.G. Rehn (1928).

Litopeltis biolleyi (Saussure, 1895)

Figs 58-59, 64-65, 66-90

Material examined: MHNG; ♀; Lectotype of *Calolampra biolleyi*, designated herewith; “San José. Amer. cent. 111r [“111r” - illegible inscription - L.A.] H. de Saussure”, “Musée San José No 3.”, “Calolampa Biolleyi Sss ♀”, genital complex in prep. 150714/04. – MHNG; 1 ♂, “620 Costa-Rica 76 Amer. cent.”, “126. Lallisca 1100 n G. Biolley [? - illegible inscription in pencil - L.A.]” “Calolampa Biolleyi Sss ♂”, genital complex in prep. 150714/03.

Redescription of male: General colour yellowish, partly brown (Figs 58-59); facial part of head with large dark brown macula (Fig. 59); eyes black; lateral sides of epicranium, 2 proximal segments of antennae and mouthparts yellowish; rest parts of antennae and maxillary palps brownish; pronotum with large central brown spot and yellowish lateral parts (Fig. 58); tegmina brown in basal part, rest part light yellowish



Figs 60-65. *Apsidopis cyclops* Saussure, 1895 (60-61), *Aptera cingulata* (Burmeister, 1838) (62-63), and *Litopeltis bolleyi* (Saussure, 1895) (64-65). (60, 62, 64) Tegmen from above. (61, 63, 65) Wing from above. Dotted areas show sclerotized parts. Abbreviations: *Ipl.*, *3pl.*, *Ant.R.Rami*, *CuA*, *CuP*, *int.tr.*, *R*, *M*, *R+M*, *Sc* - see chapter "abbreviation used in figures", for details see text. Scale bars 1 mm: a = 60, b = 61, c = 62, d = 63, e = 64, f = 65.

(Fig. 58); legs yellowish with brown maculae; abdomen dirty yellowish, darker from below, bordered with yellow along lateral sides. Surfaces smooth and lustrous, distal parts of antennae (approximately from 9-10th segments) and 5th segment of maxillary palps dull; punctuation present on pronotum, proximal parts of tegmina and, very weakly, facial part of head. Head slightly longer than wide (Figs 59, 66); ocellar spots distinct; facial part with very weak impressions between eyes and above clypeus; distance between eyes 0.5 times eye length; distance between antennal sockets 1.9 times the scape length (0.8 mm); approximate length ratio of 3rd-5th segments of maxillary palps 1.2 : 1.0 : 1.6. Pronotum as in Figs 58 and 67. Tegmina and wings completely developed, surpassing abdominal apex. Tegmina mostly membranous, only proximal part slightly sclerotized (Fig. 64); venation distinct; costal field short and narrow; *Sc* thickened (well visible on ventral side of tegmen); *R* with numerous anterior rami (Fig. 64, *Ant.R.rami*); *M* and *CuA* branches pectinate; *CuP* distinct. Wings membranous (Fig. 65); intercalated triangle absent; *Sc* simple; *RA* long, with anterior veins (Fig. 65); *RS* indistinct; *M* long and simple; *CuA* pectinate with 4 complete (reaching to wing margin) veins; behind *CuA* situated 2 long and simple veins probably corresponding to 1st and 3rd plical veins respectively (Fig. 65, *1pl.*, *3pl.*); these veins fused and incrassated basally; anal fan consisting of 13 veins reaching margin of wing; 2 possibly jugal veins situated behind anal fan. Fore tibiae very weakly thickened distally. Anterior margin of fore femora armed according to the type C (*sensu* Bey-Bienko, 1950; Roth, 2003), with single apical spine. Tibial spines well developed. Structure of hind tarsi (Figs 68-69): metatarsus about as long as other segments combined, with euplantula small and apical; euplantulae of 2nd-4th segments distinct; metatarsus with 2 more or less equal rows of spines along lower margin; "additional spines" bordering euplantulae from inside and outside present; claws symmetrical, simple; arolium distinct, but shorter than half of claw length. Metatarsal euplantulae of mid tarsi larger, as compared with those of hind legs, but shorter than one half of metatarsus length. Abdomen without visible glandular specializations (Fig. 70). Anal plate (tergite X) nearly rectangular and long; with weak median incision on caudal margin (Fig. 70). Cerci short, but segments distinct (Fig. 70). Paraprocts of blaberid-type (Fig. 71). Hypandrium asymmetrical; styli short, equal in size and cylindrical (Fig. 72).

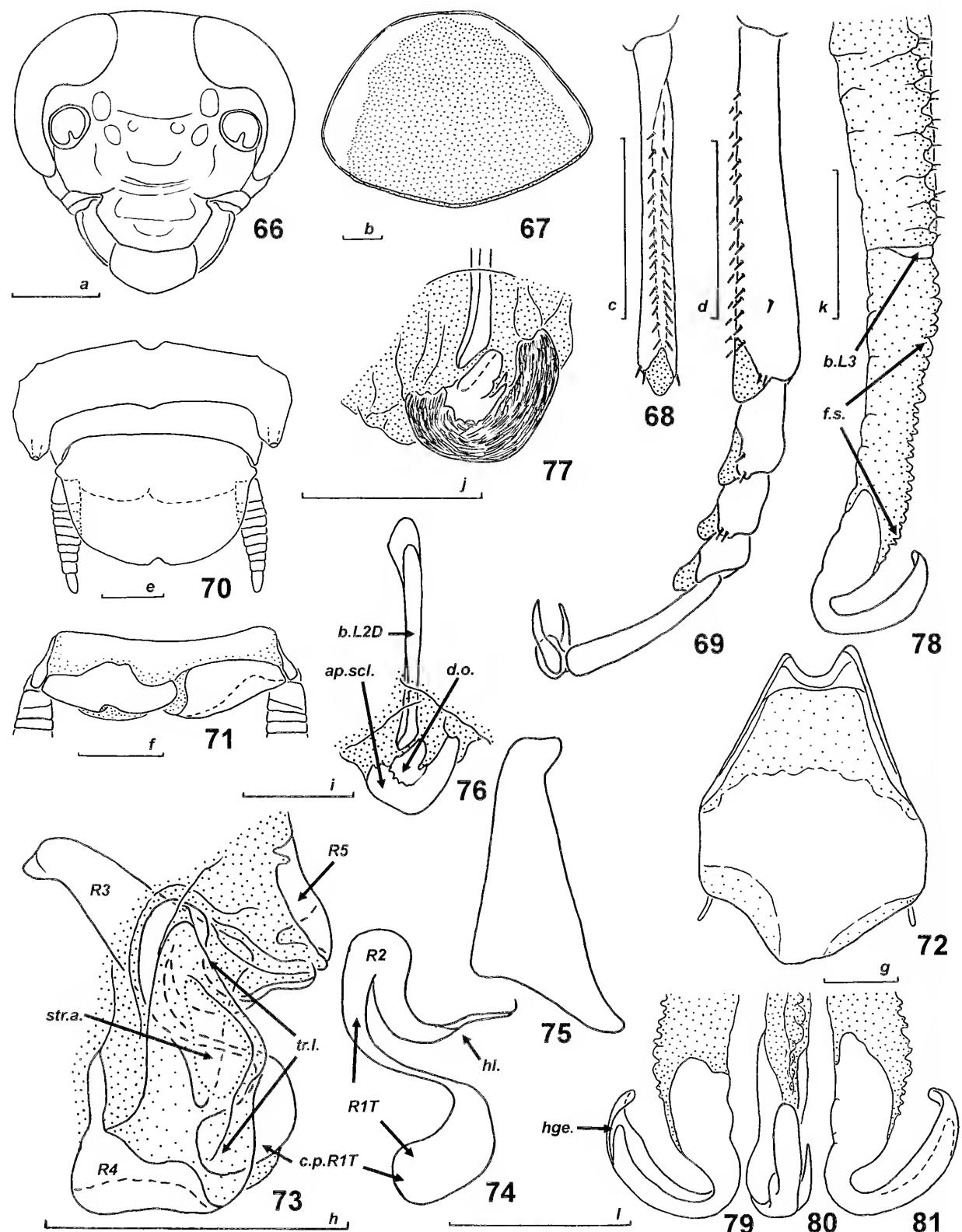
Genitalia (Figs 73-81): Right phallomere (R+N): sclerite R1T well sclerotized and curved, with caudal part short and robust (Figs 73-74, *c.p.R1T*), bristles absent; R1T and partly R2 covered with "upper triangular lobe" (Fig. 73, *tr.l.*), with area of fine striations in centre of "upper triangular lobe" (Fig. 73, *str.a.*); R2 curved, with weak hollow (Fig. 73-74, *hl.*); R3 triangular (Fig. 75); R4 large, displaced to eaudal part of phallomere; R5 small,

tray-like. Sclerite L2D (L1) divided into basal and apical parts; basal part rod-like, weakly widened cranially (Fig. 76, *b.L2D*); apical part densely covered with recumbent bristles (Fig. 76-77, *ap. scl.*); "dorsal outgrowth" flat (Fig. 76-77, *d.o.*). Sclerite L3 (L2d) with distinct basal subsclerite (Fig. 78, *b.L3*), "folded structure" distinct, with bristles (Fig. 78, *f.s.*); apex of L3 with attenuated apex; "apical crest" absent, groove *hge* present (Figs 79-81, *hge.*). Sclerite L4U (L3d) present, weakly sclerotized.

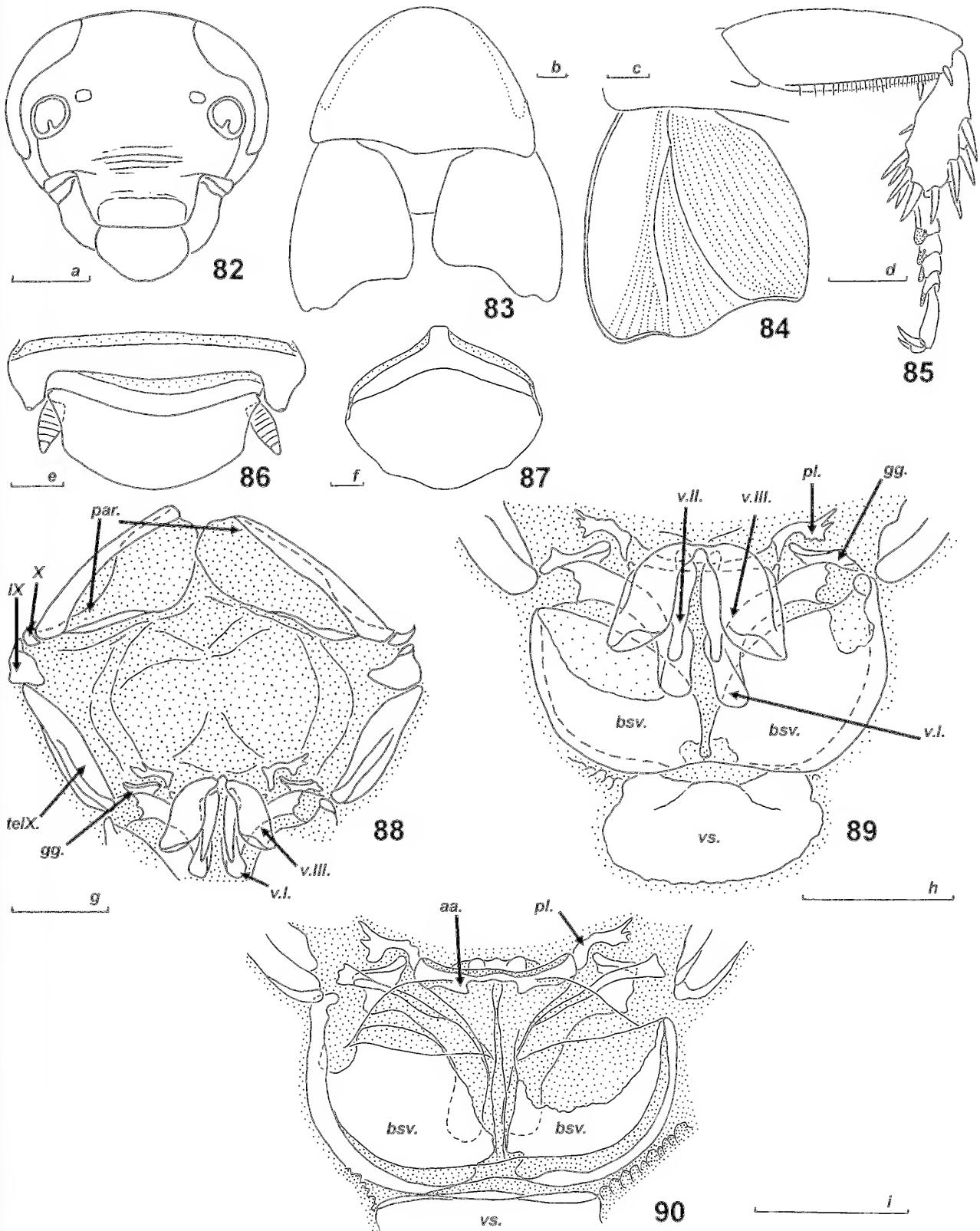
Redescription of female (lectotype): Brachypterous (Fig. 83), body convex, surfaces of abdomen strongly sclerotized. General colour darker than male, reddish-brown; pronotum with pair of yellow spots on antero-lateral margin (Fig. 83); legs lighter, yellowish. Head with eyes and ocellar spots smaller (Fig. 82) as compared with male; distance between eyes 0.8 times eye length; distance between antennal sockets 2.4 times the scape length (0.8 mm); approximate length ratio of 3rd-5th segments of maxillary palps 1.0 : 1.0 : 0.9. Pronotum campaniform, as in Fig. 83. Tegmina strongly abbreviated, as in Figs 83-84; venation obsolete, only *R* and *CuP* distinct, *Sc* thickened (visible on ventral side of tegmen). Wings vestigial. Anterior margin of fore femora armed according to the type C, with single apical spine (Fig. 85). Fore tibiae thickened distally (Fig. 85). Tibial spines well developed. Tarsal structures similar to those of male. Abdomen without visible glandular specializations (Fig. 86). Anal plate (tergite X) transverse, with caudal margin widely rounded (Fig. 86). Cerci shorter, as compared with those of male, with segments solidly connected (Fig. 86). Paraprocts medially membranous (Fig. 88, *par.*). Genital plate as in Fig. 87.

Ovipositor and adjacent structures (Figs 88-90): Intercalary sclerite absent; tergal processes of abdominal segment VIII reduced; tergal processes of abdominal segment IX completely developed (Fig. 88, *teIX*). Gonangulum distinct, well sclerotized (Figs 88-89, *gg.*). First valves of ovipositor large and membranous at apex (Figs 88-89, *v.I.*), with setae (not shown in Figs 88-89) along inner side. Base of 2nd and 3rd pairs of valves as in Fig. 90, sclerotized lobes of complicated shape (Figs 89-90, *pl.*). Anterior arch of second valvifer as in Fig. 90, *a.a.*. 2nd valves of ovipositor small (Fig. 89, *v.II.*). 3rd valves of ovipositor (gonoplacs) wide, partly membranous (Figs 88-89, *v.III.*). Basivalvulae in shape of asymmetrical widely rounded sclerotized plates with reflexed outer margin (Figs 89-90, *bsv.*). Vestibular sclerite plate-like, strongly sclerotized (Figs 89-90, *vs.*). Brood sac well developed.

Measurements (in mm): Head length: male 3.1, female 3.6; head width: male 3.0, female 3.2; pronotum length: male 4.8, female 5.2; pronotum width: male 7.0, female 7.2; tegmen length: male <20.0 (apices are broken off), female 5.2; tegmen width: male 5.5, female 5.5.



Figs 66-81. *Litopeltis biolleyi* (Saussure, 1895), male. (66) Facial part of head. (67) Pronotum, dorsal view. (68) Right hind metatarsus, ventral view. (69) Left hind tarsus, dorsal view. (70) Abdominal apex, dorsal view. (71) Paraprocts, ventral view. (72) Hypandrium, ventral view. (73) Right phallomere, dorsal view. (74) Sclerites R1T and R2, dorsal view. (75) Sclerite R3, ventral view. (76) Sclerite L2D, dorsal view. (77) Caudal part of sclerite L2D, dorsal view. (78) Sclerite L3. (79-81) Apical part of sclerite L3. Dotted areas show dark colour (67) or membranous parts (68-69, 71-73, 76-81). Abbreviations: ap.scl., b.L2D, b.L3, c.p.R1T, d.o., f.s., hge., hl., R2, R3, R4, R5, str.a., tr.l. - see chapter "abbreviation used in figures", for details see text. Scale bars 1 mm: a = 66, b = 67, c = 68, d = 69, e = 70, f = 71, g = 72, h = 73-75, i = 76, j = 77, l = 79-81.



Figs 82-90. *Litopeltis biolleyi* (Saussure, 1895), female. (82) Facial part of head. (83) Anterior part of body, dorsal view. (84) Left tegmen, dorsal view. (85) Left fore leg, anterior view. (86) Abdominal apex, dorsal view. (87) Genital plate, ventral view. (88) Paraprocts and structures of ovipositor, ventral view. (89) Ovipositor and adjacent structures, ventral view. (90) Basal part of ovipositor, view from within. Dotted lines show yellow maculae (83) or obsolete venation (84). Dotted area shows membranous parts. Abbreviations: *IX*, *X*, *aa.*, *bsv.*, *gg.*, *par.*, *pl.*, *telX.*, *v.I.*, *v.II.*, *v.III.*, *vs.* - see chapter "abbreviation used in figures", for details see text. Scale bars 1 mm: a = 82, b = 83, c = 84, d = 85, e = 86, f = 87, g = 88, h = 89, i = 90.

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**A revision of the Chilean Brachyglutini. Part 1.
Some taxonomic changes in Brachyglutini and preliminary diagnosis of *Achilia* Reitter, 1890
(Coleoptera: Staphylinidae: Pselaphinae)**

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Abstract: This first part of the review of the Chilean Brachyglutini is devoted to analyzing the taxonomic situation within the tribe and some taxonomic changes are proposed: 1. The subtribe Baradina nominally remains a part of Brachyglutini; 2. Based on the presence of median gular longitudinal elevation laterally delimited by a pair of sutures in Brachyglutina (apomorphy which characterizes the subtribe) the following genera are transferred to Brachyglutina: a) *Mangalobythus* Tanokuchi from Bythinini; b) *Sogaella* Jeannel from Iniocyphini; c) *Arachis* Raffray, *Diroprurus* Motschulsky, and *Obricala* Raffray from Brachyglutini *incertae sedis* (Newton & Chandler, 1989); and also *Berlaraxis* Jeannel and *Araneabaxis* Chandler are transferred from Brachyglutini to Iniocyphini subtribe Iniocyphina; 3. Based on the presence of two long, longitudinal lateral carinae on the metathorax the subtribe Pselaptina is reestablished (*stat. resurr.*). A preliminary diagnosis of *Achilia* Reitter is also given.

Keywords: Brachyglutini - Brachyglutina - Pselaptina - Chile - *Achilia* - taxonomy.

INTRODUCTION

This article opens a cycle of contributions devoted to a revision of Brachyglutini from Chile and Southern Argentina. First the species-rich genus *Achilia* Reitter, 1890 will be studied, then the rest of the small genera will be examined, and finally the relationship of these genera with each other and other genera of Brachyglutini will be discussed. This sequence of study is due to our desire to explore the limits of variability within the largest genus to understand taxonomic significance of the characters used by Raffray (1904), Jeannel (1962, 1963), and Franz (1996) for their respective new genera. The revision of *Achilia* will follow the boundaries of the species groups in which Jeannel (1962, 1963) divided this genus. However it is not excluded that at the end of our research the number, composition, and characteristics of the species groups will be modified, as we feel doubtful about the reliability of the characters used by these authors.

In this article the general situation within the tribe Brachyglutini and the subtribe Brachyglutina is examined, some taxonomic changes are produced, and a preliminary diagnosis of the genus *Achilia* is given.

MATERIAL AND METHODS

The present study is based on the material from the following different collections:

MHNG Muséum d'Histoire Naturelle, Genève, Switzerland (G. Cuccodoro)

MNHN Muséum National d'Histoire Naturelle, Paris, France (A. Taghavian)

ZMUM Zoological Museum, Moscow State University, Moscow, Russia (A. Gusakov)

PCSK Private collection S. Kurbatov, Moscow, Russia

Morphological terminology follows that of Chandler (2001). The abdominal tergites and sternites are numbered in Arabic for the visible segments, and in Roman for their morphological position. The visible abdominal segments begin with tergite 1 (IV) and sternite 1 (III).

More than half of all genera of Brachyglutini and several genera of Iniocyphini, Proterini and Bythinini have been studied in the course of our study. For a better understanding of the exoskeletal characters representatives of the following genera were dismembered and placed in Canada balsam:

Brachyglutini: *Acamaldes vagepunctatus*, *Achilia* spp., *Asanis* sp., *Anabaxis* sp., *Batraxis* spp., *Anchydarthon* sp., *Atenisodus* sp., *Baxyris* sp., *Brachygluta* spp.,

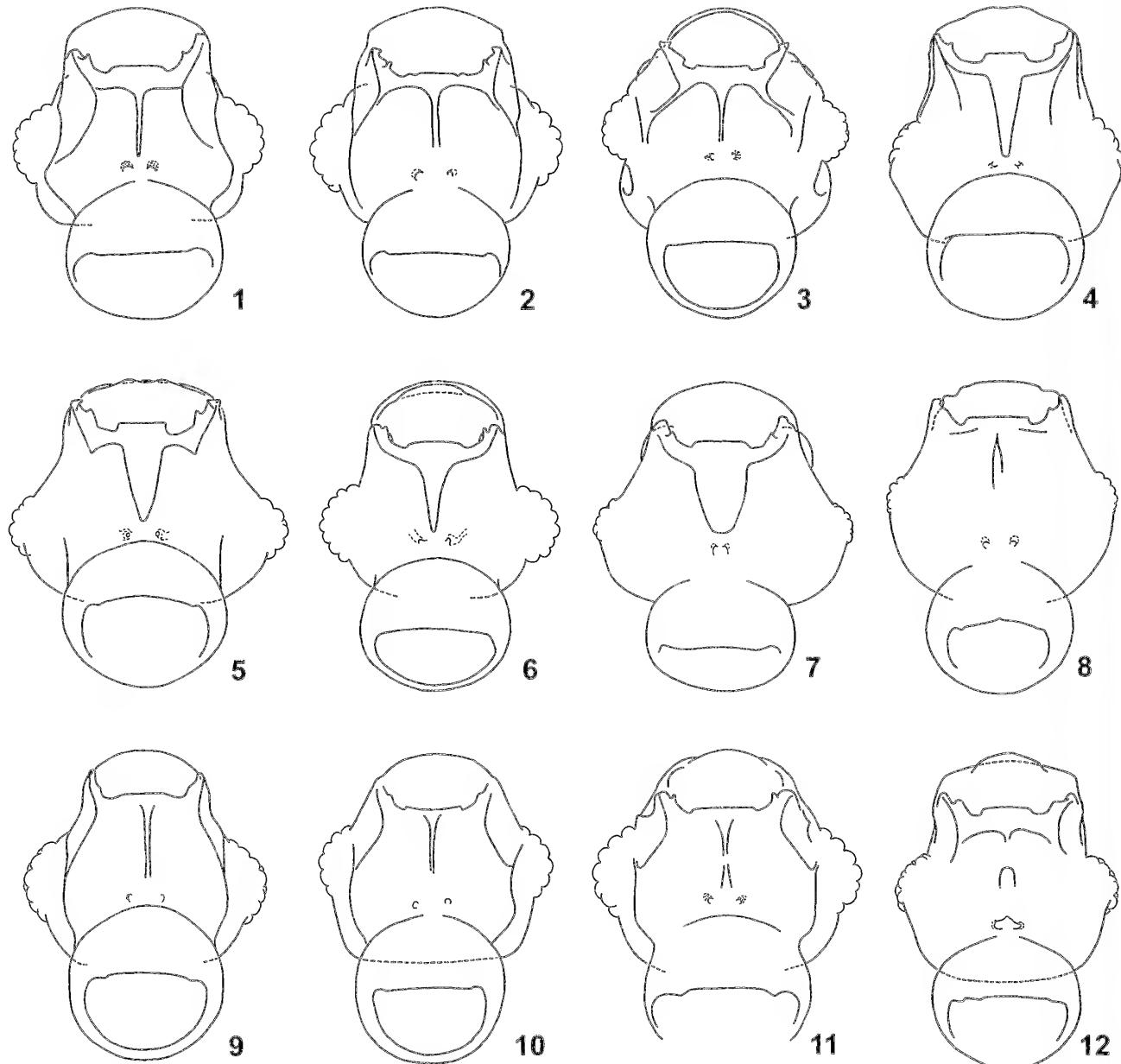
Briara sp., *Briaraxis depressa*, *Bundjulung mercurius*, *Bunoderus lucrosus*, *Bythinogaster* sp., *Caligocara* sp., *Comatopselaphus* spp., *Decarthron consanguinea*, *Drasinus cisinsularis*, *Ephymata* sp., *Euphalepsus* spp., *Eupsenius glaber*, *Eutrichites zonatus*, *Fagriezia impressa*, *Globa ?longipes*, *Mallanganee greeni*, *Nisaxis tomentosa*, *Nondulia convexa*, *Panabachia bythinioides*, *Pedisinops regulus*, *Physoplectus pardii*, *Pselaptus belfragei*, *Reichenbachia* spp., *Rybaxis diabolica*, *Tremissus inexpectatus*, *Tribatus creticus*, *Triomicrus ludificator*, *Trissemus olivieri*, *Wollomombi ligniphilus*.
Bythinini: *Mangalobythus* sp.

Iniocyphini: *Dalmoburis petrunkevitchii*, *Nipponobythus korbeli*, *Sogaella* sp.

Proterini: *Goniomellus besucheti*, *Harmomima* sp., *Proterus elenae*.

TAXONOMIC PART

The current system of Pselaphinae is still far from adequate. According to Chandler (2001: 16) 3 of the 6 higher taxa of these beetles "are difficult to define, with the Euplectitae or Goniaceritae being either



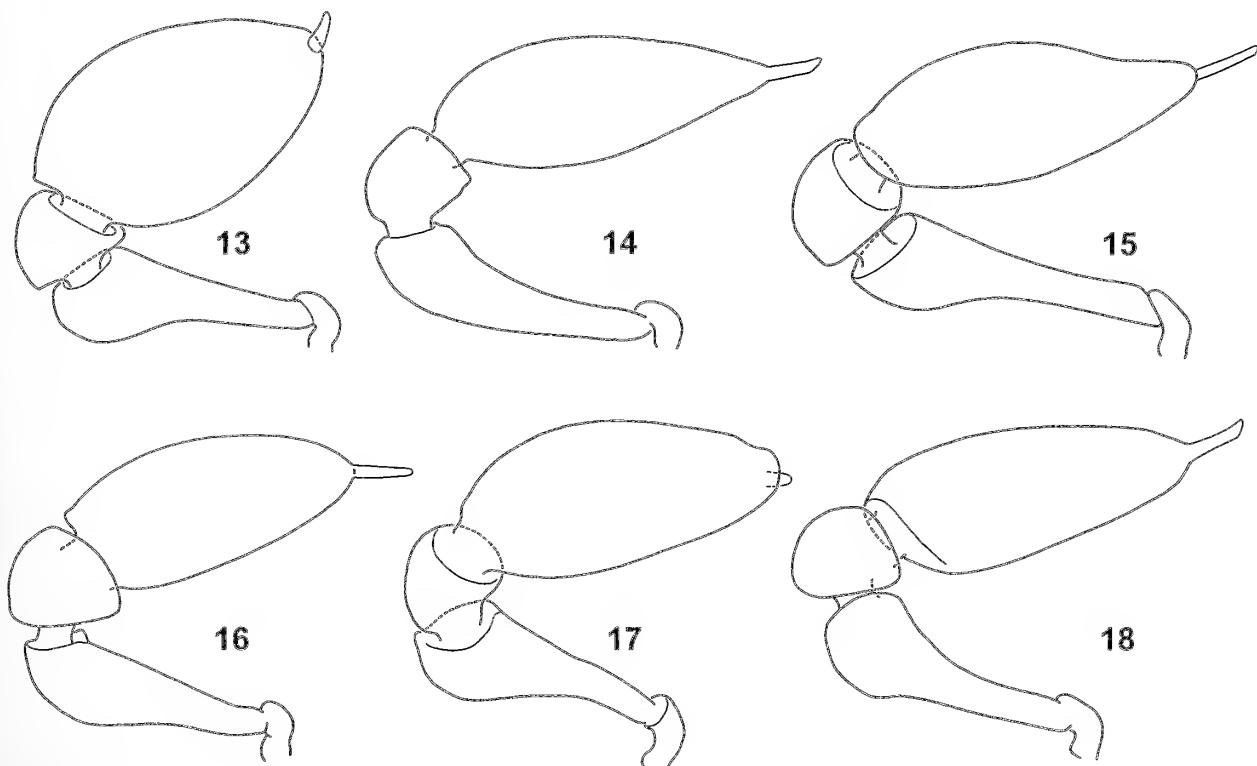
Figs 1-12. Ventral side of the head of Brachyglutini. (1) *Ephymata* sp. (2) *Bunoderus lucrosus*. (3) *Achilia crassicornis*. (4) *Acamaldes vagepunctatus*. (5) *Bundjulung mercurius*. (6) *Brachygluta trigonoprocta*. (7) *Sogaella* sp. (8) *Batraxis hampei*. (9) *Pselaptus belfragei*. (10) *Eutrichites zonatus*. (11) *Caligocara* sp. (12) *Comatopselaphus* sp.

paraphyletic or polyphyletic". We fully share this opinion on the last two taxa. The tribe Brachyglutini is part of the Goniaceritae, and, in turn, cannot be clearly characterized. In connection with this situation, for a better understanding of the position of Chilean genera within the tribe we have studied a considerable number of the world Brachyglutini as indicated in the Material and Methods.

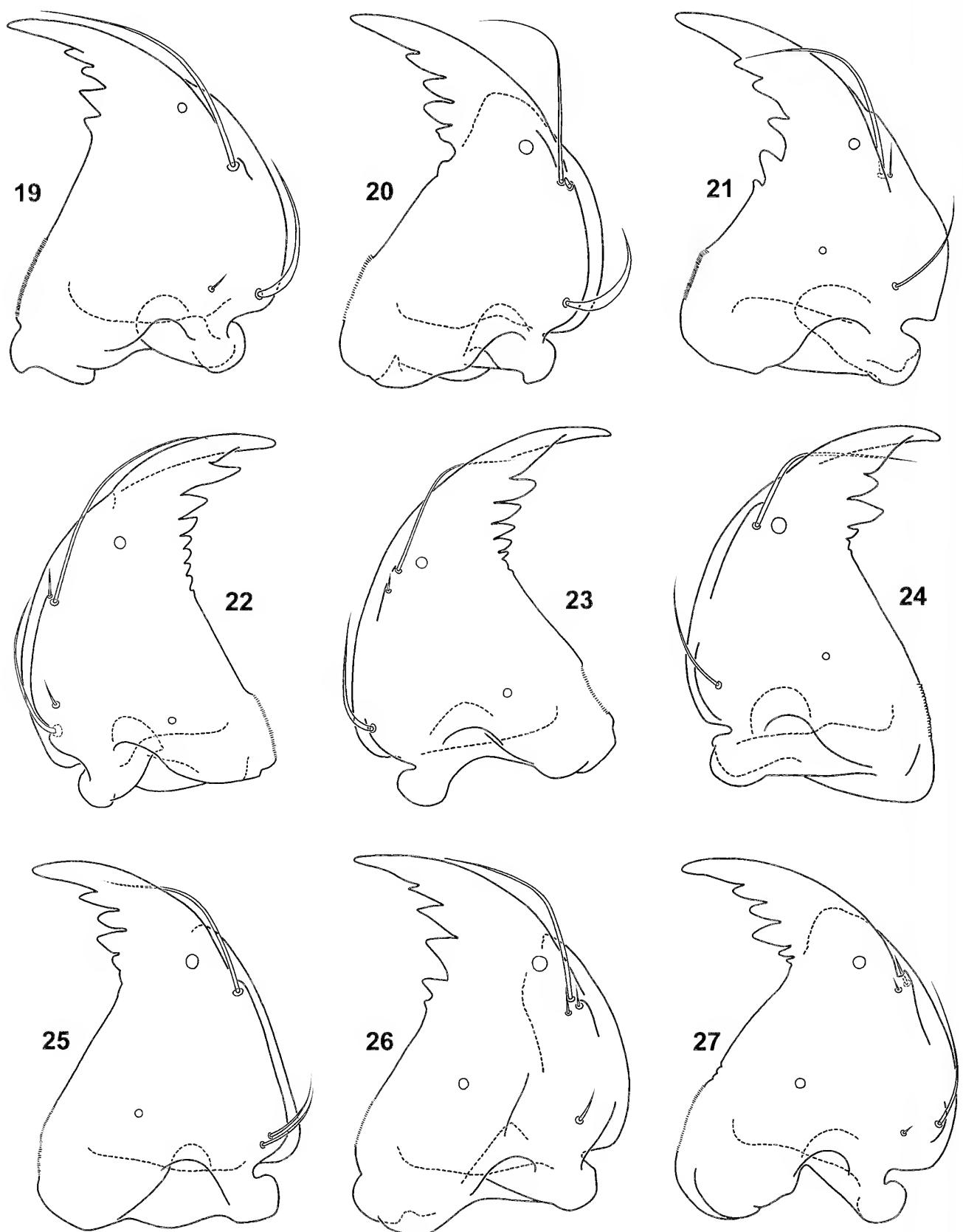
In accordance with recent taxonomic changes the Brachyglutini includes the subtribes Baradina, Brachyglutina, Decarthrina and Eupseniina (Chandler, 2001: 290). During our research we came to the following conclusions.

1. Baradina with the two included genera *Euphalepsus* Reitter, 1883a (= *Barada* Raffray, 1891; = *Tetrasemus* Jeannel, 1962; for synonymy see Chandler, 1999: 171) and *Phalespoides* Raffray, 1890 are related to a group of genera that do not belong within the Brachyglutini but for the moment are not yet placed into a single taxon. Another of our articles will be devoted to the description of this new taxon, and for now *Baradina* remains a part of the Brachyglutini. Additionally, the only species of this group reported from the Chilean fauna, *E. delamarei* (Jeannel, 1962; Franz, 1996) inhabits North-Western Argentina, i.e. an area which is not included in the region of our interest. So in this paper we will not examine the genus *Euphalepsus*.

2. The subtribe Brachyglutina is characterized by the following apomorphy: a median gular longitudinal elevation (= median gular carina *sensu* Chandler, 2001: 290) laterally delimited by a pair of sutures (Figs 1-8; see also Chandler, 2001, figs 203-204). In rare cases this elevation may be low and even not very distinct on a dried specimens, however its lateral sutures are always clearly visible on a slide preparation. The only known exception is seen in the genus *Batraxis* Reitter, 1881, which may have a partially reduced elevation and accompanying sutures in some species (Fig. 8), but it should be borne in mind that this is a very polymorphic genus with a tendency to the reduction of many morphological structures (basal elytral foveae, lateral carinae of abdominal tergites, etc.). The ventral side of the head in Brachyglutina is also often provided with infraocular carinae that extend from the gular constriction to the anterior margin of the head capsule; but these carinae may be strongly reduced up to their complete disappearance in many genera, and are not of taxonomic value in our opinion. The mandibles have two very long macrosetae (basal and medial) at the outer margin (Figs 19-24), except for the studied species of *Reichenbachia* Leach, 1826 [*R. juncorum* (Leach, 1817)] that have a shortened medial macroseta (Fig. 27), and for a few genera that have a shortened or lacking basal macroseta (e.g. *Batraxis*, *Panabachia* Park, 1942, *Pedisinops* Newton & Chandler, 1989) (Fig. 26). On the



Figs 13-18. Maxillary palpi of Brachyglutini. (13) *Achilia crassicornis*. (14) *Bunoderus lucrosus*. (15) *Baxyris* sp. (16) *Brachygluta trigonoprocta*. (17) *Nisaxis tomentosa*. (18) *Anchylarthon* sp.



Figs 19-27. Mandibles of Brachyglutini. (19) *Achilia crassicornis*. (20) *Rybaxis diabolica*. (21) *Mangalobythus* sp. (22) *Drasinus cisinsularis*. (23) *Mallanganee greeni*. (24) *Asanis* sp. (25) *Baxyris* sp. (26) *Panabachia bythinoides*. (27) *Reichenbachia junctorum*.

contrary *Baxyris* Jeannel, 1949 and *Fagniezia* Jeannel, 1950 have two very close basal macrosetae (Fig. 25). The anterior angles of the labrum are usually more or less marked, more rarely rounded (Figs 28-39). The antennae usually have 11 antennomeres (*Ectopocerus* Raffray, 1904, and males of some *Eupines* King, 1866 and *Anchylarthon* Brendel, 1887 have 10 antennomeres). Prosternum has a pair of anteroprosternal foveae (Figs 52-55). All studied representatives of the subtribe have a pair of lateral mesosternal, mesoeoxal, and metasternal foveae (Figs 56-59). Median mesosternal fovea is single in vast majority of genera; however it is more or less forked in *Anchylarthon* Brendel, *Briara* Reitter, 1882, *Briaraxis* Brendel, 1894, *Bythinogaster* Schaufuss, 1887, *Drasinus* Raffray, 1904, *Mangalobythus* Tanokuchi, 1989, and in some species of *Brachygluta* Thomson, 1859 (for ex. *Brachygluta guilleardi*, *B. haematica*, *B. helferi*, *B. iranica*, *B. trigonoprocta*, *B. turcmatica*), but is lacking in *Baxyris*. With regard to *Batraxis*, this fovea is much more forked in *B. hampei* Reitter, 1881 and is completely divided into two separate foveae in *B. splendida* Nomura, 1986 (Fig. 59). The metasternal eoxae are widely separated in all representatives of

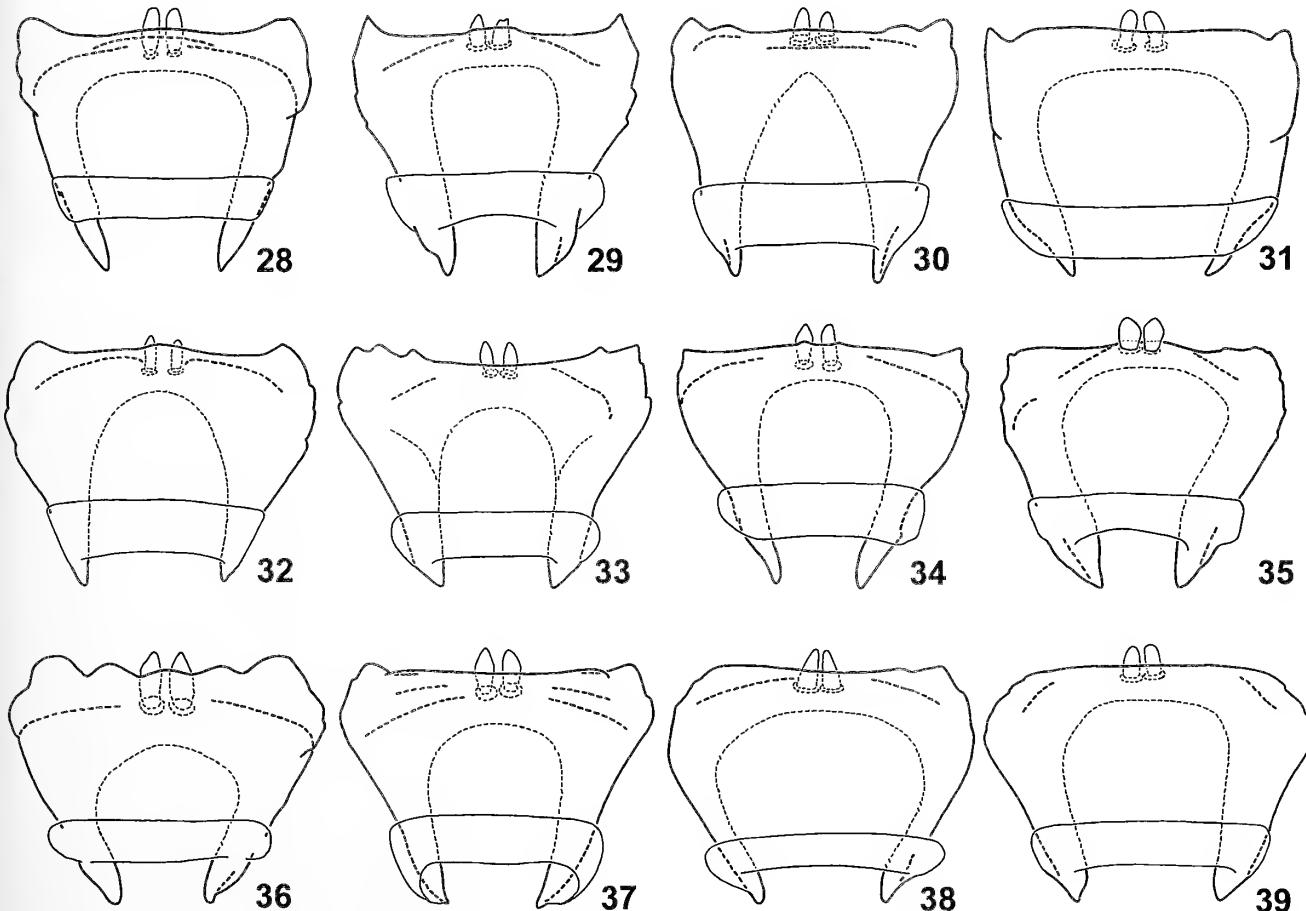
Brachyglutina. The tergites of first four segments of abdomen have clearly delimited paratergites except for certain species of *Batraxis* that have more or less fused tergites with their corresponding paratergites.

So the composition of Brahyglutina follows that of Chandler (2001) with the several exceptions:

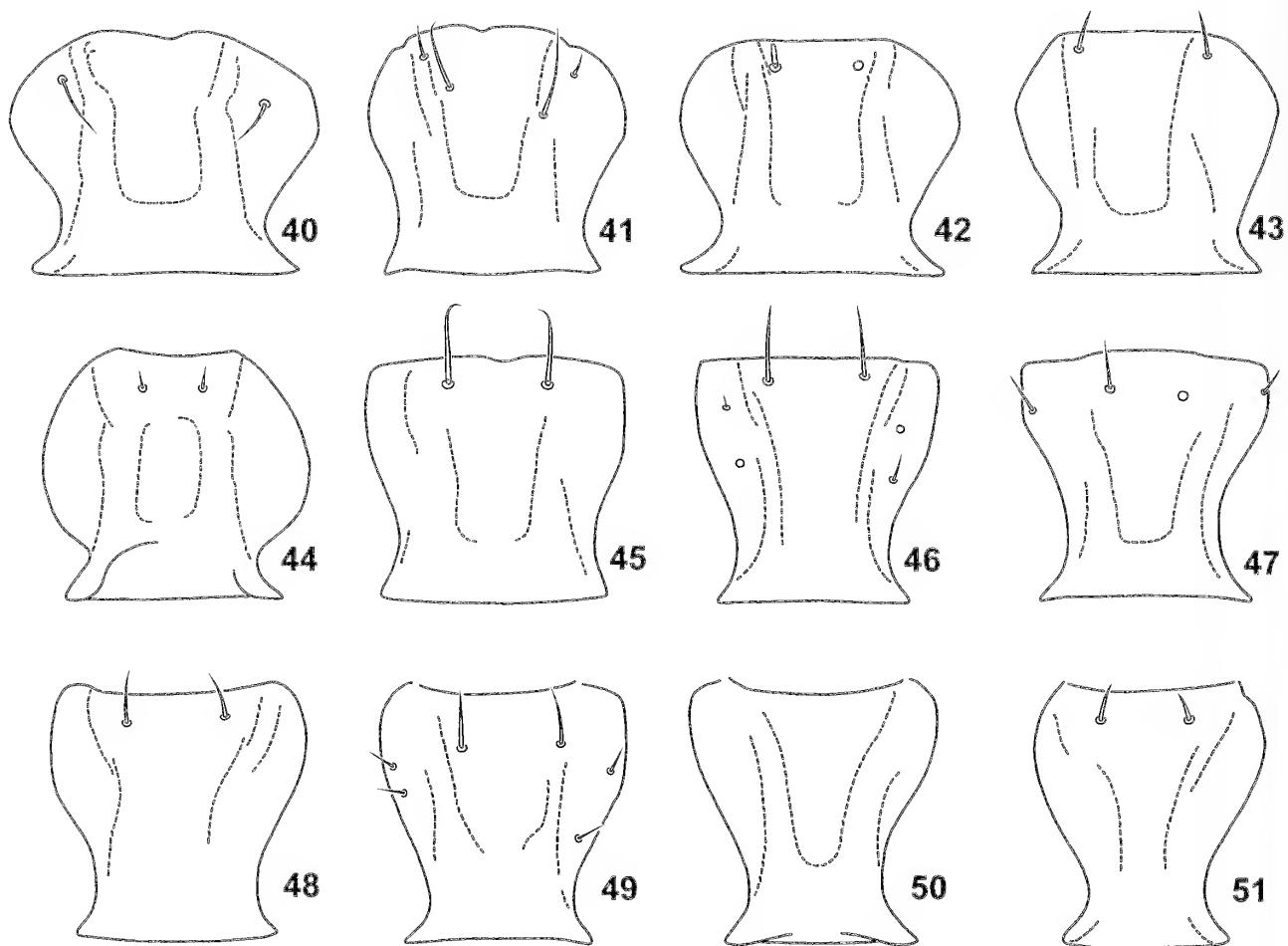
2a. Genus *Mangalobythus* Tanokuchi is transferred here from Bythinini to Brachyglutina. We have studied one undescribed species of this very characteristic genus from the mangrove forests of northern Borneo (MHNG collection), and found that it completely corresponds to the description of Brachyglutina including the prominent median gular longitudinal elevation with accompanying sutures, and the similar foveal pattern of the meso- and metasternum (Fig. 58).

2b. Genus *Sogaella* Jeannel, 1960 is transferred from Iniocyphini to Brachyglutina. Newton & Chandler (1989: 51) put *Sogaella* into the former Tanypleurini (now Iniocyphini Natypleurina).

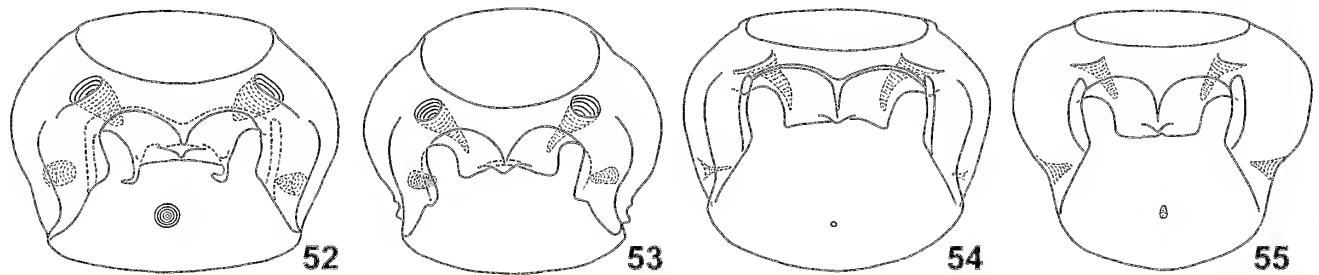
We studied a representative of *Sogaella* and were able to establish that it definitely belongs to Brachyglutina, primarily due to the structure of the ventral side of



Figs 28-39. Labrum of Brachyglutini. (28) *Brachygluta trigonoprocta*. (29) *Wollomombi ligniphilus*. (30) *Physoplectus pardii*. (31) *Tribatus creticus*. (32) *Sogaella* sp. (33) *Pedisinops regulus*. (34) *Achilia crassicornis*. (35) *Bunoderus lucrosus*. (36) *Briaraxis depressa*. (37) *Ephytymata* sp. (38) *Asanis* sp. (39) *Acamaldes vagepunctatus*.



Figs 40-51. Mentum of Brachyglutini. (40) *Achilia crassicornis*. (41) *Bunoderus lucrosus*. (42) *Panabachia bythinoides*. (43) *Briara* sp. (44) *Wollomombi ligniphilus*. (45) *Pedisinops regulus*. (46) *Brachygluta trigonoprocta*. (47) *Sogaella* sp. (48) *Ephymata* sp. (49) *Tribatus creticus*. (50) *Mangalobythus* sp. (51) *Physoplectus pardii*.

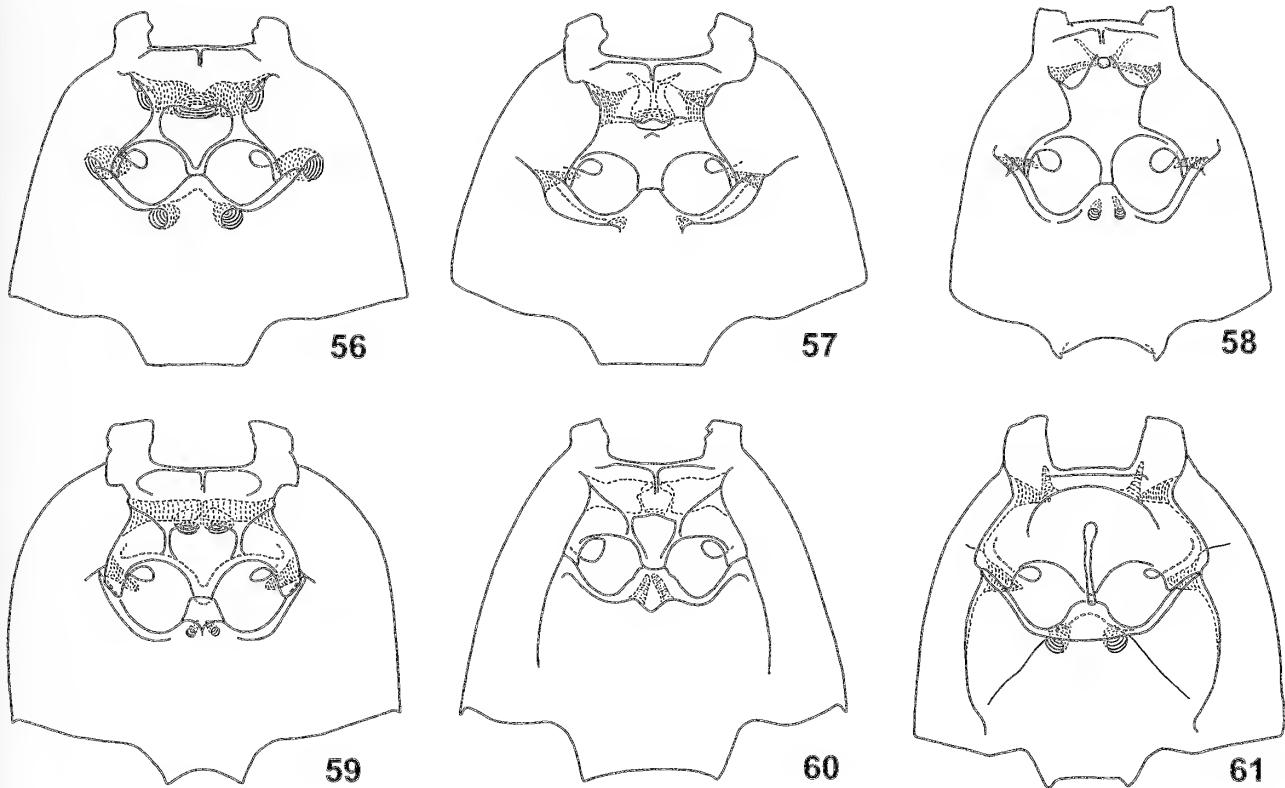


Figs 52-55. Prosternum of Brachyglutini. (52) *Achilia crassicornis*. (53) *Briara* sp. (54) *Anchylarthron* sp. (55) *Bundjulung mercurius*.

the head (Fig. 7) and some other features (see also Figs 32, 47).

2c. Genera *Arachis* Raffray, 1890, *Diroptrus* Motschulsky, 1858 and *Obricala* Raffray, 1890 are transferred from Brachyglutini *incertae sedis* (Newton & Chandler, 1989: 46-47) to Brachyglutina. We studied the type species of these three genera:

Arachis crassicornis (Raffray, 1882), *Diroptrus ceylonicus* Motschulsky, 1858 and *Obricala foveicollis* (Raffray, 1882), and we have been able to establish that they definitely belong to Brachyglutina primarily due to the structure of the ventral side of the head with the median gular longitudinal elevation laterally delimited by a pair of sutures.



Figs 56-61. Meso- and metasternum of Brachyglutini. (56) *Achilia crassicornis*. (57) *Drasinus cisinsularis*. (58) *Mangalobythus* sp. (59) *Batraxis splendida*. (60) *Eutrichites zonatus*. (61) *Comatopselaphus* sp.

2d. We here exclude the genus *Berlaraxis* Jeannel, 1957 from Brachyglutini, that was placed in this tribe among the genera *incertae sedis* (Newton & Chandler, 1989: 46-47). We have studied the holotype of *Berlaraxis coomani* Jeannel, 1957, and we came to the conclusion that this genus (having in particular a completely different underside of the head compared with other representatives of Brachyglutini) is very close to *Sunorfa* Raffray, 1882 and its allied genera due to the shape of palpalomere 4, the structure of the base of abdominal tergite 1, the shape of the aedeagus, and some other characters. Thus we transfer *Berlaraxis* to the tribe Iniocyphini subtribe Iniocyphina.

For the same reason, after the study of a paratype of *Araneabaxis oreillyi* Chandler, 2001, we exclude the genus *Araneabaxis* Chandler, 2001 from the tribe Brachyglutini subtribe Brachyglutina and transfer it to Iniocyphina, also placing it next to the genera around *Sunorfa*. Chandler (2001: 304, 385) himself wrote about the possibility of such placement as part of his description of this genus.

However, on one hand "Iniocyphini [is] difficult to characterize as a group distinct from the Proterini" (Chandler, 2001: 376), while on the other hand, the internal relationships of both tribes is currently unclear. For example, the genera close to *Morana*

Sharp, 1874 are apparently unrelated to other genera of Iniocyphina (Kurbatov *et al.*, 2007), and *Proterus* Raffray, 1897 with its allied genera are not close to other representatives of Proterini, while this "tribe [itself] is most likely polyphyletic" (Cuccodoro & Kurbatov, 2006: 251; see also Chandler, 2001: 391). That is why we do not formally put *Berlaraxis* and *Araneabaxis* in the Iniocyphina, but indicate their affinity to particular genera.

3. The subtribe Pselaptina (**stat. resurr.**) recently synonymized with Brachyglutina (Chandler, 2001: 291) is reestablished. But this reestablishment is produced on another basis than that indicated by Park (Park *et al.*, 1976: 48). This subtribe in its new concept shares with Brachyglutina the median gular longitudinal elevation delimited by lateral sutures (this elevation may be interrupted in the middle) (Figs 9-12); however, unlike Brachyglutina the subtribe Pselaptina has two long longitudinal lateral carinae on the metathorax (Figs 60-61). As so defined Pselaptina then includes the following genera: *Caligocara* Park, 1945, *Eutrichites* LeConte, 1880, *Pselaptus* LeConte, 1880, *Atenisodus* Raffray, 1904, and *Comatopselaphus* Schaufuss, 1882 with the last two genera previously placed as Brachyglutini *incertae sedis* (Newton & Chandler, 1989: 46).

Achilia Reitter

Achilia Reitter, 1890: 212; type species: *Bryaxis valdiviensis* Reitter, 1883b (= *Achilia blanchardi* Raffray, 1904) (des. Jeannel, 1962: 396).

Clermontodes Jeannel, 1950: 317 (synonymized by Besuchet, 1986: 259).

Preliminary description: Head with pair of vertexal foveae. Underside of head with distinct median gular longitudinal elevation accompanied by lateral sutures, and with partially reduced infraocular sutures (Fig. 3). Anterior margin of labrum more or less straight (Fig. 34). Anterior margin of mentum rounded, with weak median notch (Fig. 40). Outer margin of mandibles with two long macrosetae, basal and medial (Fig. 19). Palpi with 4th palpomere clearly enlarged, which is approximately two times larger than 3rd (Fig. 13).

Pronotum with antebasal and two lateral foveae, lacking any sulci. Elytra with 2-4 basal foveae, sutural and discal striae. Tergite 1 (IV) with pair of discal carinae, with pair of basolateral and sometimes pair of mediobasal foveae. Prosternum with paranotal carinae and pair of anteroprosternal foveae (Fig. 52). With single median

mesosternal fovea (Fig. 56). Sternite 2 (IV) with large mediobasal carina, with pair of mediobasal and pair of basolateral foveae.

Secondary sexual characters affect mainly the dorsal side of head and antennae, and sometimes other parts of the body.

Aedeagus with membranous basal bulb and more or less bilaterally symmetrical sclerites of internal sac.

Figures 62-63 represent the general appearance of the genus *Achilia*.

Remarks: The genus *Achilia* shares only with *Bunoderus* Raffray, 1904 the shape of the anterior margin of the mentum (rounded, with weak median notch) (Figs 40-41), and both have the same foveal pattern of the pronotum, possess both sutural and discal elytral striae, and share some other features. However unlike *Achilia* the representatives of the genus *Bunoderus* have the fourth palpomere not enlarged (Figs 13-14), just as in many other genera of Brachyglutini (Figs 15-18), the pronotal disc has a median carina or tumidity anterior to the median antebasal fovea, and sternite 2 is lacking a mediobasal carina and basolateral foveae.



62



63

Figs 62-63. Habitus of *Achilia* species. (62) *Achilia grandiceps* Jeannel, 1962. (63) *Achilia puncticeps* Reitter, 1883b.

ACKNOWLEDGEMENTS

We thank A. Taghavian (MNHN) and A. Gusakov (ZMUM) for the loan of type material, and G. Cuccodoro (MHNG) for the possibility to study different genera of Brachyglutini from the Museum's collection. The photos of the two species of *Achilia* were produced by K. Makarov (Moscow State pedagogical University). We also thank D.S. Chandler for valuable critical comments on an early version of this paper.

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An annotated list of the Orthoptera (Insecta) species described by Henri de Saussure,
with an account of the primary type material housed in the
Muséum d'histoire naturelle de Genève,
Part 6: The Rhaphidophoroidea, Stenopelmatoidea and Tettigonioidea.

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Abstract: Henri de Saussure described 82 species currently placed in the superfamilies Rhaphidophoroidea, Stenopelmatoidea and Tettigonoidea. The names are listed alphabetically, and the location of the type material (if known) and the current nomenclatural combination are given. When there is primary type material in the Muséum d'histoire naturelle de Genève (MHNG), the sex, verbatim label data and condition of the specimens is given, along with their location within the collection.

Keywords: Ensifera - Anostosomatidae - Rhaphidiophoridae - Stenopelmatidae - Tettigoniidae - type-catalogue.

INTRODUCTION

Henri de Saussure (1829-1905) was a prolific taxonomist probably best known for his work on the ‘orthopteroid’ insects (Hollier & Hollier, 2013).

Many of the Tettigoniidae described by Saussure were published in collaboration with Alphonse Pictet (1838-1903) and are listed by Hollier (2011). The majority of the species listed here were described using material collected during Saussure’s expedition to Mexico and the West Indies between 1854 and 1856 (Hollier & Hollier, 2012), or sent by correspondents encountered on the trip. These specimens were revised for the “Biologia Centrali-Americana,” and those considered junior synonyms (whether correctly or not) have identification labels only for the name considered valid by Saussure & Pictet (1897, 1898). It is possible that some type specimens are to be found amongst the duplicate and depot material having lost any labels that identify them as such (Carbonell, in litt.).

Many of the specimens identified as syntypes have printed labels reading “TYPE BRUNN”, apparently indicating that Brunner von Wattenwyl examined them in the preparation of his monographs (Hollier & Maehr, 2012), but since the type concept has changed through time, they do not necessarily correspond to type specimens in the modern sense. Many of the specimens have been studied by Theodore Hubbell (1897-1989), but his lectotype and holotype labels do not indicate published designations.

This list includes 82 species. Probable type specimens of 62 of these have been identified in the collection of the Muséum d'histoire naturelle de Genève (MHNG). Presumed types of two further species have been on loan from the MHNG collections since the 1970s.

ARRANGEMENT AND FORMAT

The species are listed alphabetically. The format for each is:

specific epithet Author, publication: page [*Original generic placement*].

Type locality as given in the original description. Type series.

Number of specimens. Specimen: “Label data” [format of label]. Following the recommendations of Ohl & Oswald (2004) the condition of each specimen is noted. Other comments. Location of material in the MHNG main Orthoptera collection. Currently valid binomen of taxon (following Eades *et al.*, 2015).

The following additional abbreviations are used in the list.

BMNH The Natural History Museum, London

FSCM Florida State Museum, University of Florida, Gainesville

MHNG Muséum d'histoire naturelle, Geneva

MNHN Muséum National d'histoire naturelle, Paris

OSF Orthoptera Species Files Online (Eades *et al.*, 2015)
 OXUM Oxford University Museum of Natural History,
 Oxford

SMNS Staatliches Museum für Naturkunde, Stuttgart
 ZMHB Museum für Naturkunde, Berlin

CATALOGUE

americanus Saussure, 1859: 201 [*Orchesticus*].

America borealis, Tennessee. Unspecified number of ♀.
 One ♀ syntype with labels: "Tenness." [printed on white card]; "Anabrus americanus Sauss." [handwritten on brown paper]; "Syntypus" [printed on red paper]. Most of both antennae, the tarsi of the right front leg and the last tarsal segment of both hind legs are missing. The left hind leg has been reattached with glue. Box K9.

Atlanticus americanus americanus (Saussure, 1859)

angustifolia Saussure, 1859: 202 [*Phylloptera*].

Bahia. Unspecified number of ♂ and ♀.

The specimens that were placed under this name, presumably syntypes, are missing from the collection. Box B30.

Anaulacomera angustifolia (Saussure, 1859)

azteca Saussure, 1859: 206 [*Acanthodis*].

Mexico. Unspecified number of ♀.

One ♀ syntype with labels: "Cordova, Mexique, t. chaude" [handwritten on white paper]; "Meroncidius aztecus, Sss. Type Sauss. (*Acanthodis*)" [handwritten on green paper]; "Syntypus" [printed on red paper]. Specimen set with left wings roughly spread and right wings folded; most of both antennae, both front legs, the last tarsal segment of both middle legs and both hind legs are lost. The wings are rather tattered and the abdomen somewhat shrivelled. The locality label of the ♂ specimen in the BMNH illustrated as a possible syntype on OSF shows that it was collected much later than the publication of the description [Höge collected for Godman and Salvin in the 1870s or 1880s (Papavero & Ibáñez-Bernal, 2003)] and is therefore not part of the type series. Box E19.

A junior synonym of *Gongrocnemis mexicana* (Saussure, 1859)

azteca Saussure, 1859: 203 [*Phylloptera*].

Mexico, Cordova etc. More than one ♀.

Lectotype ♀ (designated by Emsley, 1970: 147) with labels: "Orizaba Sumichrast" [handwritten on white paper]; "Stilpnochlora azteca Sauss." [handwritten on green paper]; "TYPE BRUNN" [printed on a strip of white paper]; "Desig. Leetotype Emsley 1969" [handwritten in pencil on white card]; "LectoTYPE Stilpnochlora azteca (Saussure, 1859)" [handwritten on red card with "TYPE" printed]. Specimen set with wings folded; the right antenna, left middle leg, the last tarsal segment of

the right middle leg and the last tarsal segment of the left hind leg are missing. There is some insect feeding damage to the abdomen. Images on OSF. Box B25.

Stilpnochlora azteca (Saussure, 1859)

bimacula Saussure, 1899: 622, fig. 18 [*Allomenus*].

Madagaskar, Majunga. Unspecified number of ♀.
 One ♀ syntype with labels: "WEST MADAGASC:" [printed on pink paper]; "Allomenus bimacula Sss ♀" [handwritten on pink paper]; "Holotypus" [printed on red card]; "Type series unspecified; treat as syntype. Hollier 2012" [handwritten on red paper]. Specimen set with wings spread; the tarsi of the right front leg and the claws of the right hind leg are missing. The ovipositor is bent near the middle. Images on OSF. Box F15.

Allomenus bimacula Saussure, 1899

brunneri Saussure, 1888: 131, 133 [*Saga*].

Asie Mineure, Ephèse; les Balkans (Brunner von Wattenwyl). Unspecified number of ♀.

One ♀ syntype with labels: "Ephèse Brunn." [handwritten on white card with a printed yellow margin]; "Saga Brunneri Sauss. ♀ Asie min." [handwritten on blue paper]; "Syntypus" [printed on red paper]. The right middle leg and the last tarsal segment of the right hind leg are missing. Box G2.

A junior synonym of *Saga natoliae* Seville, 1838

cavernarum Saussure, 1862: 492-494 [*Raphidoptera*].

Etats-Unis, Grotte du Mammouth. Unspecified number of ♂ and ♀.

Three ♂ and four ♀, all syntypes. A ♂ with labels: "4 42, Mammuth Cave [sic], Etats Unis, M. Marcket" [handwritten on ruled white card with "Etats Unis" printed]; "Hadenoecus subterraneus Scud." [handwritten on green paper]; "Lectotypus, Raphidoptera cavernarum Saussure" [handwritten by Hubbell on red card with "Lectotypus" printed]. Specimen lacks the last tarsal segment of the right front leg, the entire left middle leg and the last tarsal segment of the left hind leg. The specimen is breaking apart between the pro- and mesothorax due to a build-up of verdigris where the pin is inserted. A ♂ with labels: "4 42, Mammuth Cave [sic], Etats Unis, M. Marcket" [handwritten on ruled white card with "Etats Unis" printed]; "Hadenoecus subterraneus Scud." [handwritten on green paper]; "Musée de Genève N° 50" [numerals handwritten on printed white card]; "Syntypus" [printed on red paper]. Specimen lacks most of both antennae and both front legs. The left hind leg, which lacks the tarsi, is detached and secured through the femur on the original pin. The femur and tibia of the right hind leg are broken and repaired with glue. A ♂ with labels: "4 42, Mammuth Cave [sic], Etats Unis, M. Marcket" [handwritten on ruled white card with "Etats Unis" printed]; "Hadenoecus subterraneus Scud." [handwritten on green paper]; "Syntypus" [printed on red paper]. Specimen lacks the left front leg, both middle

legs, the right hind leg and the tarsi of the left hind leg. A ♀ with labels: "4 42, Mammuth Cave [sic], Etats Unis, M. Marcket" [handwritten on ruled white card with "Etats Unis" printed]; "Hadenoecus subterraneus Scud." [handwritten on green paper]; "Allotypoid, Raphidoptera cavernarum Saussure" [handwritten by Hubbell on red card with "Allotypoid" printed]. Specimen lacks the left antenna and the tibia and tarsi of the left hind leg. A ♀ with labels: "4 42, Mammuth Cave [sic], Etats Unis, M. Marcket" [handwritten on ruled white card with "Etats Unis" printed]; "Hadenoecus subterraneus Scud." [handwritten on green paper]; "Syntypus" [printed on red paper]. Specimen lacks most of the left antenna, the left front and middle legs and the tibia and tarsi of the right hind leg. A ♀ with labels: "4 42, Mammuth Cave [sic], Etats Unis, M. Marcket" [handwritten on ruled white card with "Etats Unis" printed]; "Hadenoecus subterraneus Scud." [handwritten on green paper]; "Syntypus" [printed on red paper]. Specimen lacks the left front and middle legs and part of the tibia and the tarsi of the right hind leg. The left hind leg has been reattached with glue. A ♀ with labels: "4 42, Mammuth Cave [sic], Etats Unis, M. Marcket" [handwritten on ruled white card with "Etats Unis" printed]; "Hadenoecus subterraneus Scud." [handwritten on green paper]; "Syntypus" [printed on red paper]. Specimen lacks most of both antennae and the right front leg. The left hind leg, which lacks part of the tibia and the tarsi, is detached and secured through the femur on a separate pin. Box O9.

A junior synonym of *Hadenoecus subterraneus* (Sudder, 1861)

chilensis Saussure, 1859: 211 [*Stenopelmatus*].

Chili. Unspecified number of ♀.

Four possible syntypes, all ♀. A ♀ with labels: "Phalangopsidis Brun, Chile Valverde" [handwritten on white paper]; "103" [handwritten on pink paper]; "Musée de Genève N° 103" [numerals handwritten on printed white card]; "Cratomelus armatus Blanch." [handwritten on green paper]; "Mesomedes armatus Bl. (Cratomelus)" [handwritten on squared paper]; "Holotypus, Stenopelmatus chilensis Sauss. THH" [handwritten by Hubbell on red card with "Holotypus" printed]; "Possible syntype! Unspecified series. Hollier 2014" [handwritten on red paper]. Apart from the ends of the antennae the specimen is intact. A ♀ with labels: "Phalangopsidis Brun, Chile Valverde" [handwritten on white paper]; "Musée de Genève N° 104" [numerals handwritten on printed white card]; "Cratomelus armatus Blanch." [handwritten on green paper]; "Possible syntype of Stenopelmatus chilensis Sauss. Hollier 2014" [handwritten on red paper]. Apart from the ends of the antennae the specimen is intact. A ♀ with labels: "Chili" [printed on white card]; "77" [handwritten on green paper]; "Cratomelus armatus Blanch." [handwritten on green paper]; "Possible syntype of Stenopelmatus chilensis Sauss. Hollier 2014" [handwritten on red paper]. Apart from the ends of the antennae the specimen

is intact. A ♀ with labels: "Chile" [printed on white card]; "Cratomelus armatus Blanch." [handwritten on green paper]; "Possible syntype of Stenopelmatus chilensis Sauss. Hollier 2014" [handwritten on red paper]. Specimen lacks most of both antennae, the claws of the left front and left middle leg and the last tarsal segment of the left hind leg. It is not clear why Hubbell considered one of these specimens to be the holotype although there is another with the same data. The specimen that fits best with the measurements given in the original description is that labelled "Chile" and since this small printed label is of the type used by Saussure for the material collected on his Mexico expedition, this specimen is the most probable syntype. Box O6.

A junior synonym of *Cratomelus armatus* Blanchard, 1851

couloniana Saussure, 1861: 128-129 [*Phylloptera*].

Cuba. Unspecified number of ♀.

One ♀ syntype with labels: "Stilpnochiora Couloniana, Sss." [handwritten on green paper]; "Identified as Type, Emsley 1969" [handwritten in pencil on white card]; "HoloTYPE ♀, Stilpnochiora couloniana Saussure, 1861" [handwritten by Emsley on red card with "TYPE" printed]; "Type series unspecified; treat as syntype. Hollier 2012" [handwritten on red paper]. The species name label in the insect box has the locality "Cuba" handwritten in the lower left corner. Specimen set with wings spread, the left forewing being lost; both antennae, the last tarsal segment of the left front leg, the last tarsal segment of the right middle leg, the claws of the left hind leg and the last tarsal segment of the right hind leg are missing. The abdomen has been eviscerated and stuffed. Images on OSF. Box B25.

Stilpnochiora couloniana (Saussure, 1861)

couloni Saussure, 1862: 490-492, pl. XII fig. 1 [*Anostostoma*].

Île de Java (Mus. Neuchâtel). One ♀.

The single ♀ specimen placed under this name in the MHNG collection is from Sumatra, and was collected after the publication of the original description. The holotype could not be located in the collection of the Muséum d'histoire naturelle de Neuchâtel (Borer, pers. comm.). Box O1.

A junior synonym of *Sia ferox* Giebel, 1861

dentata Saussure, 1899: 615 [*Arantia*].

Insula Mauritius. Unspecified number of ♂.

The MHNG collection contains two ♂ specimens under this name, but they both have the locality label "CAMERUN" and are therefore not part of the type series. These specimens probably belong to *A. orthocnemis* Karsch, 1890 (Massa, pers. comm.). The whereabouts of the type material is unknown. Box B10.

Arantia dentata Saussure, 1899

dentifrons Saussure, 1859: 207 [*Conocephalus*].

Bahia, Bahia. Unspecified.

Holotype ♀ with labels: “*Conocephalus dentifrons* Sauss., Bahia n° 22” [handwritten on white paper]; “*Conocephalus irroratus* Burm.” [handwritten on green paper]; “Holotypus” [printed on red card]. Specimen set with wings folded; the left antenna, the last tarsal segment of the left hind leg, part of the femur and the tibia and tarsi of the right hind leg and the entire abdomen are lost. There is insect feeding damage to the head and thorax. This species was synonymized (erroneously) with *C. irroratus* Burmeister, 1838 by Saussure & Pictet (1898: 390), who also noted that the ♀ type of *C. dentifrons* Saussure lacks the abdomen. Box F7. A junior synonym of *Neoconocephalus tuberculatus* (De Geer, 1773)

dentipes Saussure, 1899: 617-618, fig. 26 [*Parapyrrhicia*].

Nossi-Bé. Unspecified number of ♀.

One ♀ syntype with labels: “Nossibé” [handwritten on pink paper]; “*Parapyrrhicia dentipes*, Sss.” [handwritten on pink paper]; “Syntypus” [printed on red paper]. Specimen set with wings folded; the left middle leg, the tibia and tarsi of the right middle leg and the entire left hind leg are lost. The right hind leg, which lacks the last tarsal segment, is detached and glued to a card mount on the original pin. Images on OSF. Box B31.

Parapyrrhicia dentipes Saussure, 1899

derodifolia Saussure, 1859: 203 [*Phylloptera*].

Bahia. Unspecified.

One ♂ syntype with labels: “*Phylloptera derosifolia* [sic], Sss. Bahia” [handwritten on green paper]; “Holotypus” [printed on red card]; “Type series unspecified; treat as syntype. Hollier 2012” [handwritten on red paper]. Specimen set with wings roughly folded; the right antenna, two tarsal segments of both front legs, the tarsi of the right middle leg and two tarsal segments of the right hind leg are lost. The left hind leg, which lacks the last tarsal segment, and the adjacent part of the thorax are detached and glued to a card mount on the original pin. Images on OSF. Box B32.

Phylloptera derodifolia Saussure, 1859

ensifolia Saussure, 1859: 202 [*Phylloptera*].

Bahia. Unspecified number of ♂.

One ♂ syntype with labels: “*Turpilia ensifolia*, Sauss, Brésil” [handwritten on green paper]; “Holotypus” [printed on red card]; “Type series unspecified; treat as syntype. Hollier 2012” [handwritten on red paper]. Specimen set with wings folded, the left forewing has been raised to expose the file; both antennae, both front legs, both middle legs, the left hind leg and two tarsal segments of the right hind leg are lost. Images on OSF. Box B34.

Phylloptera ensifolia Saussure, 1859

erinifolia Saussure, 1859: 203 [*Phylloptera*].

Bahia. Unspecified number of ♂.

The specimens that were placed under this name are missing from the collection. Box B30.

Anaulacomera erinifolia (Saussure, 1859)

fedtschenkoi Saussure, 1874: 45-46 [*Decticus*].

Prope Maracandam et prope Bairakum ad flumen Jaxartem. More than one ♂.

No specimens found in the MHNG. The whereabouts of the type material is unknown.

Roeseliana fedtschenkoi (Saussure, 1874)

furcatus Saussure, 1899: 624-625, fig. 21 [*Dicranacrus*].

Madagaskar. Unspecified number of ♂.

No specimens found in the MHNG. The whereabouts of the type material is unknown.

Dicranacrus furcatus Saussure, 1899

grandidieri Saussure, 1899: 628, figs 24-27 [*Colossopus*].

Madagaskar. Unspecified number of ♂ and ♀.

Leetotype ♂ (designated by Ünal & Beccaloni, 2008: 35) with labels: “Madagask. Grandid.” [handwritten on white paper]; “*Colossopus Grandidieri* Sauss.” [handwritten on pink paper]; “Syntypus” [printed on red paper]; “Lectotypus design. Ünal & Beccaloni, 2008” [handwritten on red paper]. The specimen lacks the right front leg, the tibia and tarsi of the right middle leg and the last tarsal segment of the right hind leg. There are two ♀ paratypes present. There are further ♀ paratypes in the MNHN (Unal & Beccaloni, 2008). Images on OSF. Box F21.

Colossopus grandidieri Saussure, 1899

gratiosa Saussure, 1898a: 229, fig. 9 [*Euparthenus*].

Borneo. Unspecified number of ♂.

Two ♂ syntypes. A ♂ with labels: “S. Borneo, H. Fruhstorfer” [printed on orange paper]; “*Euparthenus gratiosa* Sauss.” [handwritten on yellow paper]; “Syntypus” [printed on red paper]. Specimen set with left wings spread and right wings folded; most of both antennae, the right front leg, the left middle leg and both hind legs are lost. A ♂ with labels: “Bunnei, N E Borneo, Staudinger” [printed on yellow paper]; “*Eupartheneus graeiosa* [sic] Sauss.” [handwritten on yellow paper]; “*Euparthenus gratiosa* Sauss.” [handwritten on yellow paper]; “Syntypus” [printed on red paper]. Specimen set with wings spread; the last tarsal segment of the right middle leg and the claws of the right hind leg are lost, as is the entire abdomen. The left hind leg is detached and secured through the femur on the original pin. There is insect feeding damage to the thorax. There are two other apparently contemporaneous ♂ specimens from Java which are not syntypes. Box B10.

A junior synonym of *Leptoderes ornatipennis* Serville, 1838

hastata Saussure, 1898a: 807 [*Ephippigera*].

Morocco, Rabat. Unspecified number of ♂ and ♀.

One ♂ and two ♀ syntypes. A ♂ with labels: "Rabat Maroc v98" [handwritten on pink paper]; "Ephippigera hastata Sauss." [handwritten on blue paper]; "MIKROFO. 92/III: 0 und 92/V: 16 Pronot. u. Titill." [typewritten in red on yellow paper with "16" added in pencil]; "Syntypus" [printed on red paper]. The right antenna, the last tarsal segment of the left front leg, the last tarsal segment of the left hind leg and the entire right hind leg are lost. The legs appear to have been reattached with glue. Part of the genitalia has been dissected and is glued to a card mount on the original pin. A ♀ with labels: "Rabat Maroc v98" [handwritten on pink paper]; "Ephippigera hastata Sauss." [handwritten on blue paper]; "Syntypus" [printed on red paper]. The right antenna and most of the left antenna are missing. A ♀ with labels: "Rabat Maroc v98" [handwritten on pink paper]; "Ephippigera hastata Sauss." [handwritten on blue paper]; MIKROFO. 92/III: Pronot. v. oben" [typewritten in red on yellow paper]; "Syntypus" [printed on red paper]. Most of the right antenna and the claws of the left middle leg are missing. The left hind leg has been reattached with glue. There is also an immature ♀ with the same data which could be considered a syntype. The ♂ pronotum is illustrated in Nadig (1994: 998). Box L1.

Uromenus hastatus (Saussure, 1898).

hastata Saussure, 1888: 149-150 [*Hemisaga*].

Afrique (mérédionale?). Unspecified number of ♀.

No specimens found in the MHNG. There is a ♀ syntype, referred to as the holotype on OSF, in the MNHN.

A junior synonym of *Hemisaga denticulata* (White, 1841)

histrio Saussure, 1859: 210-211 [*Stenopelmatus*].

Mexico. Unspecified.

One immature ♂ syntype with labels: "Mexique, Orizaba, envoi Sumichrast" [handwritten on white paper]; "Stenopelmatus histrio Sauss." [handwritten on green paper]; "Holotypus, Stenopelmatus histrio Sauss. THH" [handwritten by Hubbell on red card with "Holotypus" printed]; "Unspecified series; treat as syntype. Hollier 2013" [handwritten on red paper]. The last tarsal segment of the right front leg is missing. Box O1.

Stenopelmatus histrio Saussure, 1859

hospodar Saussure, 1898b: 226, fig. 10 [*Jaquetia*].

Romania, Dobroga, Mangalia (leg. Jaquet). Unspecified number of ♂ and ♀.

One possible syntype, an immature ♀ with labels: "Jaquetia hospodar Sauss." handwritten on blue paper; "Jaquetia hospodar Sss." [handwritten on blue paper]; "Possible syntype of J. hospodar Sauss. Hollier 2012" [handwritten on red paper]. The species name label in the insect box has the locality "Roumanie" handwritten in the lower left corner. This species was described from

immature specimens and so the two adult specimens placed under this name in the MHNG cannot be syntypes; unlike the immature specimen in the MHNG they have only one identification label. Kis & Peschev (1967: 106) redescribed the species on the basis of adults reared from nymphs captured at the type locality. There are further syntypes in the ZMHB (images on OSF). Box B2.

Isophya hospodar (Saussure, 1898)

huasteca Saussure, 1859: 205 [*Phylloptera*].

Mexico. Unspecified number of ♀.

One ♀ syntype with labels: "Tampico, t. tempères" [handwritten on white paper]; "Phyllopt. huasteca Sss, n sp. ♀" [handwritten on white paper]; "TYPE BRUNN" [printed on a strip of white paper]; "Amblycorypha huasteca Sauss." [handwritten on green paper]; "Holotypus" [printed on red card]; "Type series unspecified; treat as syntype. Hollier 2012" [handwritten on red paper]. Specimen set with wings spread; both antennae, both front legs, the left middle leg and both hind legs are lost. There is insect feeding damage to the thorax. Images on OSF. Box B28.

Amblycorypha huasteca (Saussure, 1859)

imhoffiana Saussure, 1861: 130 [*Acanthodis*].

Mexico. Unspecified number of ♂.

There are no specimens under this name in the MHNG. The single ♂ specimen identified as a syntype of *Cocconotus castus* Brunner von Wattenwyl, 1895 (Hollier & Maehr, 2012; OSF), which was described on the basis of an unspecified number of ♂ specimens from Mexeo in the MHNG, is possibly a syntype of *A. imhoffiana* which had lost any identification label before Brunner saw the material, but there is no way to verify this. Images on OSF. Box E25.

Calamoptera imhoffiana (Saussure, 1861)

jocosa Saussure, 1888: 152-153, figs 1-2 [*Peringueyella*].

Afrique mérédionale. Unspecified number of ♂ and ♀.

One ♂ and one ♀, both syntypes. A ♂ with labels: "Cap b. sp." printed on ruled white card; "Peringuella jacosa [sic] Sauss." [handwritten on pink paper]; "Peringueyella jocosa jocosa SAUSS. det. Kaltenbach" [printed on white card]; "Type" printed on red card; "Lectotypus" [printed on red card]. Part of both antennae and most of the femur and the tibia and tarsi of the right front leg are missing. A ♀ with labels: "Cap b. sp." Printed on ruled white card; "Peringuella jacosa [sic] Sauss." [handwritten on pink paper]; "Peringueya jocosa Sss." [handwritten on white paper]; "Peringueyella jocosa jocosa SAUSS. det. Kaltenbach" [printed on white card]; "Type" printed on red card; "Syntypus" [printed on red paper]. The last tarsal segment of the right front leg, the entire left middle leg and part of the tibia and the tarsi of the left hind leg are missing. The femora and tibiae of the hind legs have been folded, presumably when the specimen was fresh, to facilitate transport. There are also two immature

specimens with the same data which could be considered syntypes. Box G3.

Peringueyella jocosa Saussure, 1888

jurinei Saussure, 1862: 489, pl. XI figs 4-7 [*Corycus*]. Patrie inconnu, Amérique du sud? (coll. Jurine). One ♂. Holotype ♂ with labels: "Afrique or., Anc. Dépôt" [handwritten on ruled white card]; "Genre Corucus [sic] Sauss." [handwritten on white paper]; "C. Jurinei Sauss. ♂ Amérique?" [handwritten on white paper]; "Corycus Jurinei Sauss." [handwritten on pink paper]; "Holotypus" [printed on red card]. The species name label in the insect box has a green margin, indicating that Saussure had thought the species was Central or South American; the distribution is actually West African, as the pink identification label suggests. Specimen set with wings roughly folded; both antennae, the tibia and tarsi of the left front leg and the entirety of the other legs are lost. There is insect feeding damage to much of the body. It seems highly likely that the species was based on a single specimen of uncertain locality and that the holotype label is correct. Images on OSF. Box D8.

Corycoidea jurinei (Saussure, 1862)

lalandaei Saussure, 1888: 140, 143-144 [*Clonia*].

Afrique méridionale; Terre des Betchuanas; Cafrière. Unspecified number of ♀.

One ♀ syntype with labels: "Cap b Esp," [printed on pink paper]; "Clonia Lalandaei Bln ♀" [handwritten on purple paper]; "Clonia Lalandaei Blanch" [handwritten on pink paper]; "Clonia (Hemiclonia) lalandaei SAUSS. det. Kaltenbach" [printed on white card]; "Syntypus" [printed on red paper]. Specimen set with wings spread, the margins very tattered; the tarsi of the left hind leg and the last tarsal segment of the right hind leg are lost. Saussure ascribed this species to Blanchard without citing a publication. Kaltenbach (1971) noted that there are syntypes in the MNHN. Box G3.

Clonia lalandaei Saussure, 1888

ledereri Saussure, 1888: 131, 134 [*Saga*].

Syrie (leg. Lederer). Unspecified number of ♂ and ♀.

One ♂ and one ♀, both syntypes. A ♂ with labels: "Beirut coll. Lederer" [handwritten on white paper]; "Saga ledereri Sss. Syrie" [handwritten on blue paper]; "Syntypus" [printed on red paper]. The last tarsal segment of the left front leg, the tibia and tarsi of the right front leg, the last tarsal segment of the left hind leg and two tarsal segments of the right hind leg are missing. A ♀ with labels: "Saga ledereri Sss. Syrie" [handwritten on blue paper]; "Syntypus" [printed on red paper]. The last tarsal segment of both front legs and the claws of the left hind leg are lost. Images on OSF. Box G1.

Saga ledereri Saussure, 1888

legumen Saussure, 1859: 205 [*Phylloptera*].

America. Unspecified number of ♀.

One ♀ syntype with labels: "Lobophyllus legumen Sauss." [handwritten on green paper]; "Holotypus" [printed on red card]; "Type series unspecified; treat as syntype. Hollier 2012" [handwritten on red paper]. The species name label in the insect box has the locality "Brésil" handwritten in the lower left corner. Specimen set with right wings spread and left wings folded; most of both antennae, the last tarsal segment of the left front leg, the right front leg, both middle legs, two tarsal segments of the left hind leg and the right hind leg are missing. There is insect feeding damage to the thorax. Images on OSF. Box B37.

Lobophyllus legumen (Saussure, 1859)

leprosipes Saussure, 1899: 625, fig. 22 [*Amblylakis*].

Madagascar. One damaged ♀.

No specimens found in the MHNG. The whereabouts of the holotype is unknown.

Amblylakis leprosipes Saussure, 1899

lobata Saussure, 1898a: 232, 236-238, fig. 16 [*Ephippigera*].

Algeria occidentalis, Orania meridionalis; Ain-Sefra leg. Saussure, Mecheira leg. Pictet. Many ♂ and ♀.

Lectotype ♂ designated by Nadig (1995: 127) with labels: "621 10 Ain Sefra, Algerie, M^r A. Pictet" [handwritten on ruled white card with "Algerie" printed]; "AIN SEFRA" [printed on a strip of pink paper]; "Ephippigera lobata Sauss." [handwritten on blue paper]; "Lecto-Holo-Typus A. Nadig" ["Lecto-Holo-" typewritten, "Typus" printed and "A. Nadig" handwritten on red card]. Most of the right antenna and the last tarsal segment of the left front leg are missing. Dissected genitalia are glued to a card mount on the original pin. There are seven ♂ and five ♀ paralectotypes (one of the ♀ having been labelled as "Lecto-Allotypus" by Nadig). There are further paralectotypes in the BMNH, OXUM and ZMHB according to OSF (images on OSF). Box L1.

Uromenus innocentii lobatus (Saussure, 1898)

lucasii Saussure, 1888: 132, 135-136 [*Saga*].

Syrie (Muséum de Paris). Unspecified number of ♂.

No specimens found in the MHNG. According to the original description the types should be in the MNHN.

A junior synonym of *Saga ornata* Burmeister, 1838

maroccana Saussure, 1898a: 231, 235-236, fig. 15 [*Ephippigera*].

Morocco, Tanger. More than one ♂ (variation of anal segment mentioned).

Two ♂ syntypes. A ♂ with labels: "MAROC" [printed on a strip of pink paper]; "Ephippigera maroccana Sauss." [handwritten on blue paper]; "MIKROFOT. 92:1: 19,21,22" [typewritten in red ink on yellow paper]; "Syntypus" [printed on red paper]. The species name label in the insect box has the locality "Tanger" handwritten in the lower left corner. The right middle leg and two tarsal

segments of the left hind leg are lost. The left middle leg is tightly folded and the apex glued under the body so that the tarsi are invisible. Part of the genitalia has been dissected and is glued to a card mount on the original pin. The dissected genitalia are illustrated by Nadig (1994: 992). A ♂ with labels: "MAROC" [printed on a strip of pink paper]; "Ephippiger maroccana Sauss." [handwritten on blue paper]; "Syntypus" [printed on red paper]. The tarsi of the left front leg, the last tarsal segment of the right middle leg, part of the tibia and the tarsi of the left hind leg and the last tarsal segment of the right hind leg are missing. Box L2.

Uromenus maroccanus (Saussure, 1898)

mauretanica Saussure, 1898a: 231, 233-234
[*Ephippigera*].

Morocco. Many ♂ and ♀.

Seven ♂ and four ♀ syntypes. A ♂ with labels: "Tanger Sept. 94" [handwritten on white card]; "6" [handwritten on white card]; "Ephippiger mauretanica Sauss." [handwritten on blue paper]; "Syntypus" [printed on red paper]. Both antennae, the last tarsal segment of the left front leg, the claws of the left middle leg and the tarsi of the right hind leg are lost. A ♂ with labels: "620 61 Maroc, M^r Vaucher" [handwritten on ruled white card]; "Tanger" [printed on a strip of pink paper]; "Ephippiger mauretanica Sauss." [handwritten on blue paper]; "Syntypus" [printed on red paper]. Most of both antennae are missing. A ♂ with labels: "620 61 Maroc, M^r Vaucher" [handwritten on ruled white card]; "Tanger" [printed on a strip of pink paper]; "Ephippiger mauretanica Sauss." [handwritten on blue paper]; "Syntypus" [printed on red paper]. The tarsi of the right front leg, the last tarsal segment of the left middle leg and the claws of the right middle leg are lost. A ♂ with labels: "620 61 Maroc, M^r Vaucher" [handwritten on ruled white card]; "Tanger" [printed on a strip of pink paper]; "Ephippiger mauretanica Sauss." [handwritten on blue paper]; "Syntypus" [printed on red paper]. Most of the right antenna and the right middle leg are missing. There is mould damage to the specimen. A ♂ with labels: "620 61 Maroc, M^r Vaucher" [handwritten on ruled white card]; "Tanger" [printed on a strip of pink paper]; "Ephippiger mauretanica Sauss." [handwritten on blue paper]; "U. mauretanicus Sauss. ♂ det. Nadig" [handwritten on white card with "det. Nadig" printed]; "Syntypus" [printed on red paper]. Both antennae, the last tarsal segment of the left front leg and the entire right hind leg are lost. Dissected genitalia are glued to a card mount on the original pin. A ♂ with labels: "Tanger" [printed on a strip of pink paper]; "Ephippiger mauretanica Sauss." [handwritten on blue paper]; "Syntypus" [printed on red paper]. Most of both antennae, the last tarsal segment of the left hind leg and most of the tibia and the tarsi of the right hind leg are missing. The right front leg is detached and glued to

a card mount on the original pin. Part of the dissected genitalia is glue to a second card mount on the original pin. A ♂ with labels: "620 61 Maroc, M^r Vaucher" [handwritten on ruled white card]; "Tanger" [printed on a strip of pink paper]; "Ephippiger mauretanica Sauss." [handwritten on blue paper]; "Syntypus" [printed on red paper]. The last tarsal segment of the left middle leg and the last tarsal segment of both hind legs are lost. A ♀ with labels: "620 61 Maroc, M^r Vaucher" [handwritten on ruled white card]; "Tanger" [printed on a strip of pink paper]; "Ephippiger mauretanica Sauss." [handwritten on blue paper]; "Syntypus" [printed on red paper]. A ♀ with labels: "Tanger Sept. 94" [handwritten on white card]; "5" [handwritten on white card]; "Ephippiger mauretanica Sauss." [handwritten on blue paper]; "Syntypus" [printed on red paper]. The right antenna, the last tarsal segment of the left front leg and the entire right middle leg are missing. A ♀ with labels: "620 61 Maroc, M^r Vaucher" [handwritten on ruled white card]; "Tanger" [printed on a strip of pink paper]; "Ephippiger mauretanica Sauss." [handwritten on blue paper]; "U. mauretanicus Sauss. ♀ det. Nadig" [handwritten on white card with "det. Nadig" printed]; "Syntypus" [printed on red paper]. Most of both antennae are lost. A ♀ with labels: "620 61 Maroc, M^r Vaucher" [handwritten on ruled white card]; "Tanger" [printed on a strip of pink paper]; "Ephippiger mauretanica Sauss." [handwritten on blue paper]; "U. mauretanicus Sauss. ♀ det. Nadig" [handwritten on white card with "det. Nadig" printed]; "Syntypus" [printed on red paper]. The left antenna, most of the right antenna, the right front leg and the last tarsal segment of the left hind leg are missing. The dissections were done by Adolf Nadig, who illustrated the ♂ genitalia (Nadig, 1994: 960). There are further syntypes in the BMNH and OXUM according to OSF. Images on OSF. Box L2.

Uromenus mauretanicus (Saussure, 1898)

mauritiana Saussure, 1899: 615-616 [*Arantia*].

Insula Mauritius. Unspecified number of ♂.

One ♂ syntype with labels: "MAURITIUS" [printed on a strip of white paper]; "Musée" [handwritten on pink paper]; "Arantia mauritiana Saussure" [handwritten on pink paper]; "Holotypus" [printed on red card]; "Type series unspecified; treat as syntype. Hollier 2012" [handwritten on red paper]. Specimen set with wings spread; most of both antennae, the last tarsal segment of the left front leg and the last tarsal segment of the right hind leg are missing. Images on OSF. Box B10.

Arantia mauritiana Saussure, 1899.

mexicana Saussure, 1859: 206 [*Acanthodis*].

Tellus mexicana. Unspecified number of ♀.

Two ♂ syntypes. A ♂ with labels: "Mirador, t. tempérés" [handwritten on white paper]; "Acanthodis mexicana Sss. ♂ n° 64" [handwritten on white paper]; "Anchiptolis mexicana Sauss. (inconstans Br.)" [handwritten on green paper]; "Holotypus Acanthodis Mexicana Ss."

[handwritten by Hubbell on red card with "Holotypus" printed]; "Type series unspecified; treat as syntype. Hollier 2012" [handwritten on red paper]. Specimen set with left wings spread and right wings folded; the right antenna, the last tarsal segment of the right front leg, two tarsal segments of the left middle leg, the last tarsal segment of the right hind leg, two tarsal segments of the left hind leg and the last tarsal segment of the right hind leg are lost. The left front leg (which lacks the last tarsal segment) is detached and glued to a card mount on the original pin. A ♂ with labels: "Cordova t.c." [printed on white card]; "mexicana Sss" [handwritten in pencil on white paper]; "Anchiptolis mexicana Sauss." [handwritten on green paper]; "Probably a syntype of *A. mexicana* Sauss. Hollier 2012" [handwritten on red paper]. Specimen set with wings folded. The original publication gives the gender of the types as female, but this was corrected by Saussure & Pictet (1898: 421). Some of the other specimens placed under this name in the MHNG have been identified as probable syntypes of *A. inconstans* Brunner von Wattenwyl, 1895 (Hollier & Maehr, 2012; OSF). Images on OSF. Box E21.

Gongrocnemis mexicana (Saussure, 1859)

mexicana Saussure, 1859: 207 [*Coprophara*].

Mexico. Unspecified number of ♀.

One ♀ syntype with labels: "Cordova (Mexique) t. chaudes" [handwritten on white paper]; "Eriolus mexicanus Sss." [handwritten on green paper]; "Holotypus" [printed on red card]; "Type series unspecified; treat as syntype. Hollier 2012" [handwritten on red paper]. Specimen set with wings folded; the left antenna, both front legs, both middle legs and the right hind leg are missing. The left hind leg has been reattached with glue. There is considerable insect feeding damage to the head, thorax and the base of the abdomen. Images on OSF. Box F2.

Erioloides mexicanum (Saussure, 1859)

mexicana Saussure, 1861: 129 [*Phaneroptera*].

Mexico. Unspecified.

A ♂ and a ♀ specimen that were identified as syntypes of *Scudderia furculata* Brunner von Wattenwyl, 1878 (Hollier & Maehr, 2012; OSF) are probably also syntypes of *P. mexicana* Saussure, the latter having been erroneously placed as a junior synonym of the former by Saussure & Pictet (1897: 331). A ♂ with labels: "Mexique, Sumichrast" [handwritten on white paper]; "furculata Br." [handwritten on green paper]; "Syntypus" [printed on red paper]; "Probably a syntype of *Phaneroptera mexicana* Sauss. Hollier 2012" [handwritten on red paper]. Specimen set with wings folded; most of the left and the entire right antenna are missing, both front legs lack tibiae and tarsi and both hind legs are missing. A ♀ with labels: "Orizaba, Sumichrast" [handwritten on white paper]; "Scudderia furculata Br." [handwritten on green paper]; "TYPE BRUNN" [printed on a strip of white

paper]; "Syntypus" [printed on red paper] "Probably a syntype of *Phaneroptera mexicana* Sauss. Hollier 2012" [handwritten on red paper]. Specimen set with wings folded; most of both antennae are missing, as are the right middle leg and the left hind leg, and the last tarsal segment of the right front leg. Box B21.

Scudderia mexicana (Saussure, 1861)

mexicana Saussure, 1859: 204 [*Phylloptera*].

Mexico. Unspecified number of ♀.

A ♀ syntype with labels: "Mexique, Sumichrast" [handwritten on white paper]; "mexicana Sss." [handwritten on green paper]; "TYPE BRUNN" [printed on a strip of white paper]; "Holotypus *Phylloptera mexicana* Sauss?" [handwritten by Hubbell on red card with "Holotypus" printed]; "Holotypus Agrees with descr. - Measurements slightly too large THH" [handwritten by Hubbell on red card with "Holotypus" printed]; "Type series unspecified treat as syntype. Hollier 2012" [handwritten on red paper]. Specimen set with wings folded; most of both antennae, two tarsal segments of the right front leg and the left middle leg are lost. Hubbell has labelled a ♂ as the allotype, but the original description only mentions the ♀. Images on OSF. Box B29.

Orophus mexicanus (Saussure, 1859)

mexicanum Saussure, 1859: 208 [*Xiphidium*].

Mexico. Unspecified number of ♂ and ♀.

Four ♂ and three ♀ syntypes. A ♂ with labels: "Mexique Sumichrast" [hand written on white paper]; "Xiphid. mexicanum Sss. ♂ type n° 74" [handwritten on pale green paper, the numerals "74" are written over "22"]; "Xiphidium mexicanum Sauss." [handwritten on green paper]; "Syntypus" [printed on red paper]. Specimen set with wings folded; the right hind leg is missing. The left hind leg is detached and glued to a card mount on the original pin. A ♂ with labels: "Mexique Sumichrast" [hand written on white paper]; "Xiphidium mexicanum Sss 71" [handwritten on pale green paper]; "Xiphidium mexicanum Sauss." [handwritten on green paper]; "Syntypus" [printed on red paper]. Specimen set with wings folded; the left hind leg is lost. A ♂ with labels: "Mexique Sumichrast" [handwritten on white paper]; "2." [handwritten on a small square of white card]; "Xiphidium mexicanum Sauss." [handwritten on green paper]; "Syntypus" [printed on red paper]. Specimen set with wings folded; the last tarsal segment of the left hind leg is missing. A ♂ with labels: "Orizaba Sumichrast" [handwritten on white paper]; "1," [handwritten on a small square of white card]; "Xiphidium mexicanum Sauss." [handwritten on green paper]; "Syntypus" [printed on red paper]. Specimen set with wings folded. A ♀ with labels: "Mirador" [handwritten on white card]; "Xiphidium mexicanum Sss ♀ type n° 71" [handwritten on pale green paper, the numerals "71" being written over "22"]; "Xiphidium mexicanum Sauss." [handwritten on

green paper]; “Syntypus” [printed on red paper]. The last tarsal segment of both front legs, the last tarsal segment of the left middle leg, the entire right middle and right hind leg and the last tarsal segment of the left hind leg are lost. There is insect feeding damage to the abdomen. A ♀ with labels: “Oaxaca” [handwritten on white card]; “Xiphidium mexicanum Sss. n° 25 71” [handwritten on pale green paper]; “Xiphidium mexicanum Sauss.” [handwritten on green paper]; “Syntypus” [printed on red paper]. The right antenna, the left middle leg and part of the tibia and the tarsi of the right hind leg are lost. There is insect feeding damage to the abdomen and the hind legs. A ♀ with labels: “Oaxaca” [handwritten on white card]; “Xiphidium mexicanum Sauss.” [handwritten on green paper]; “Syntypus” [printed on red paper]. Most of both antennae, the last tarsal segment of the left hind leg and the entire right hind leg are missing. There are three juvenile specimens with similar locality labels that might be considered syntypes. The pale green labels appear to be in Saussure’s own handwriting. When *X. mexicanum* was placed in the genus *Conocephalus* it became a homonym of *C. mexicanum* Saussure, 1859 and the latter name was conserved by Rehn & Hebard (1915: 250), while *X. mexicanum* was replaced by an available junior synonym. Box F23.

Replacement name *Conocephalus ictus* (Scudder, 1875)

mexicanus Saussure, 1859: 208 [*Conocephalus*].

Mexico. Unspecified number of ♂.

There are no ♂ specimens placed under this name in the MHNG, and the two ♀ specimens with labels that appear to be roughly contemporaneous with the description are much bigger than the measurements given therein. The whereabouts of the type material is unknown. Box F7.
Neoconocephalus mexicanus (Saussure, 1859)

mexicanus Saussure, 1859: 212 [*Daihinia*].

Mexico. Unspecified.

One ♂ and one ♀, both syntypes. A ♂ with labels: “Mirador” [handwritten on a strip of white card]; “*Glaphyrosoma mexicanum* Sauss” [handwritten on green paper]; “Holotypus” [printed on red card]; “Unspecified series; treat as syntype. Hollier 2014” [handwritten on red paper]. Specimen lacks both antennae, the tarsi of the left front leg, the last tarsal segment of the right front leg, the tarsi of the left middle leg and the tarsi of the right hind leg. The left hind leg is detached and secured through the femur on a separate pin. A ♀ with labels: “Potrero, Sumichrast” [handwritten on whitish paper]; “*Glaphyrosoma mexicanum* Sauss ♀” [handwritten on green paper]; “Probable syntype of *G. mexicanum* Sauss. Hollier 2014” [handwritten on red paper]. Specimen lacks most of both antennae, the last tarsal segment of the right front leg, the tarsi of the right middle leg and the entire left hind leg. Mirador was one of the localities visited by Saussure and Sumichrast on Saussure’s Mexico expedition (Hollier & Hollier, 2012). There are further syntypes in the SMNS (Holstein & Ingrish, 2004), and

it seems likely that the “Boleros” of the data labels of those specimens is a mis-transcription of Potrero, where Sumichrast collected many specimens. Box O5.

Glaphyrosoma mexicanum (Saussure, 1859)

mexicanus Saussure, 1859: 209 [*Schoenobates*].

Mexico. Unspecified number of ♂.

One possible syntype, a ♂ with labels: “*Podetus mexicanus* Sss Mexic T.” [handwritten on green paper]; “*Schoenobates mexicanus* Sauss.” [handwritten on green paper]; “Musée de Genève N° 112” [numerals handwritten on printed white label]; “Lectotypus, should be designated, T H Hubbell” [handwritten on red card with “Lectotypus” printed]. The left antenna, most of the right antenna, the tibia and tarsi of both front legs, the tibia and tarsi of the left middle leg, the last tarsal segment of the right middle leg and the claws of the right hind leg are missing. The measurements do not correspond with those given in the description. There is a ♀ labelled as “Allotypus” by Hubbell, but only the ♂ was mentioned in the original description and so the identification of this specimen as a syntype is doubtful. Two juvenile ♂ labelled “Mexique, Orizaba, Sumichrast” may also be considered syntypes but they appear to belong to a series which includes juvenile ♀ specimens. Box O4.

Anabropsis mexicana mexicana (Saussure, 1859)

mexicanus Saussure, 1859: 210 [*Stenopelmatus*].

Mexico. Unspecified.

One ♂ and one ♀ syntype. An immature ♂ with labels: “Cordova” [handwritten on a strip of white card]; “*St. mexicanus* Sss., n° 30, ♂” [handwritten on white paper]; “68” [handwritten on green paper]; “*Stenopelmat. talpa* Sauss.” [handwritten on green paper]; “Allotypus, *Stenopelmatus mexicanus* Sauss. THH” [handwritten by Hubbell on red card with “Allotypus” printed]. Specimen lacks the tarsi of the left front leg, the last tarsal segment of the left middle leg, the right middle leg and the last tarsal segment of both hind legs. A ♀ with labels: “Cordova” [handwritten on a strip of white card]; “*Stenopelmatus Burm., mexicanus* Sauss., ♀, M H. de S., n° 30” [handwritten on an irregular piece of whitish paper with some brown staining]; “69” [handwritten on green paper]; “*Stenopelmat. talpa* Sauss.” [handwritten on green paper]; “Lectotypus, *Stenopelmatus mexicanus* Sauss. THH” [handwritten by Hubbell on red card with “Lectotypus” printed]. Specimen lacks two tarsal segments of the left front leg, the tarsi of the right front leg, the claws of the left middle leg, the tibia and tarsi of the right middle leg, the tarsi of the left hind leg and the last tarsal segment of the right hind leg. The lectotype does not appear to have been formally designated. Box O1.

A junior synonym of *Stenopelmatus talpa* Burmeister, 1838

minor Saussure, 1859: 210 [*Stenopelmatus*].

Mexico. Unspecified number of ♂ and ♀.

One ♂ and one ♀, both syntypes. A ♂ with labels: "Cordova" [handwritten on a strip of white paper]; "St. minor Sss." [handwritten on white paper]; "91" [handwritten on green paper]; "Stenopelmatus minor Sauss." [handwritten on green paper]; "Allotypus, Stenopelmatus minor Sauss. THH" [handwritten by Hubbell on red card with "Allotypus" printed]. Specimen lacks most of both antennae, the claws of the left front leg, the last tarsal segment of the right front leg, the claws of the left middle leg and the entire right middle and right hind legs. A ♀ with labels: "Cordova" [handwritten on a strip of white paper]; "Stenopelmatus minor Sss." [handwritten on white paper]; "92" [handwritten on green paper]; "Stenopelmatus minor Sauss." [handwritten on green paper]; "Lectotypus, Stenopelmatus minor Sauss. THH" [handwritten by Hubbell on red card with "Lectotypus" printed]. Specimen lacks most of both antennae, the last tarsal segment of the right front leg, the last tarsal segment of both middle legs and the claws of the right hind leg. A juvenile specimen collected by Sumichrast may also be considered a syntype. The lectotype does not seem to have been formally designated. Box O1.

Stenopelmatus minor Saussure, 1859*nasutus* Saussure, 1899: 623, fig. 19 [*Dicranacrus*].

Madagaskar. Unspecified number of ♂ and ♀.

One ♂ and one ♀, both syntypes. A ♂ with labels: "WEST MADAGASC." [printed on pink paper]; "VOELTZKOW" [printed on white paper]; "Dicranacrus nasutus Sss. + Bol. [sic] ♂" [handwritten on pink paper]; "Syntypus" [printed on red paper]. The specimen lacks the left hind leg and the last tarsal segment of the right hind leg. The right hind femur is bent in the middle so that it is folded over the abdomen. A ♀ with labels: "WEST MADAGASC." [printed on pink paper]; "VOELTZKOW" [printed on white paper]; "Dicranacrus nasutus Sss. & Bol. [sic] ♀" [handwritten on pink paper]; "Syntypus" [printed on red paper]. The specimen lacks the last tarsal segment of the left hind leg. Images on OSF. Box F21.

Dicranacrus nasutus Saussure, 1899*nieti* Saussure, 1859: 208 [*Conocephalus*].

Mexico. Unspecified number of ♀.

There are six specimens placed under this name in the MHNG but none can be identified as a syntype; three are from Cuba (two of which are ♂), one from Guatemala and one from Texas. The sixth is a ♀ without a locality label but the specimen is larger than the measurement given in the description. The whereabouts of the type material is unknown, and the species is referred to as a *nomen dubium* on OSF. Box F9.

Neoconocephalus nieti (Saussure, 1859)*nieti* Saussure, 1859: 210 [*Stenopelmatus*].

Mexico. Unspecified number of ♂.

One ♂ syntype with labels: "Mexiq." [printed on white card]; "Stenopelmat nieti Sss., Cordova" [handwritten on bluish paper]; "Stenopelmatus nieti Sauss." [handwritten on green paper]; "Holotypus, Stenopelmatus nieti Sauss." [handwritten by Hubbell on red card with "Holotypus" printed]; "Unspecified series; treat as syntype. Hollier 2013" [handwritten on red paper]. Specimen lacks most of both antennae, the last tarsal segment of the right middle leg and the right hind leg. The other two specimens under this name in the MHNG collection are ♀ and since the original description only mentions the ♂ they are not syntypes. Box O1.

Stenopelmatus nieti Saussure, 1859*occidentalis* Saussure, 1859: 208 [*Conocephalus*].

Haiti. Unspecified number of ♀.

The specimens placed under this name in the MHNG appear to have been collected after the publication of the description and none has the locality Haiti. The neotype designated by Walker & Greenfield (1983: 368) is in the FSMC. Box F12.

Neoconocephalus occidentalis (Saussure, 1859)*orthoxiphia* Saussure, 1892: 11 [*Miosaga*].

Nouvelle-Hollande (Musée Britannique). Unspecified number of ♀.

No specimens found in the MHNG. The type material, referred to as the holotype on OSF, is in the BMNH according to their online database.

A junior synonym of *Psacadonotus seriatus* Redtenbacher, 1891

otomia Saussure, 1859: 204 [*Phylloptera*].

Mexico. Unspecified number of ♂.

One ♂ syntype with labels: "Microcentrum otomium Sauss" [handwritten on green paper]; "Holotypus" [printed on red card]; "Type series unspecified; treat as syntype. Hollier 2012" [handwritten on red paper]. The species name label in the insect box has the locality "Mexique" handwritten in the lower left corner. Specimen set with wings folded; the left antenna, the tarsi of the left front leg, the last tarsal segment of the left middle and left hind legs and the entire right hind leg are missing. The right front leg, which lacks the tarsi, and the right middle leg, which lacks two tarsal segments, are detached and glued to a card mount on the original pin. Images on OSF. Box B35.

Orophus otomius (Saussure, 1859)*pisifolia* Saussure, 1859: 202-203 [*Phylloptera*].

Mexico. Unspecified number of ♂.

One ♂ syntype with labels: "Phylloptera pisifolia, Sss." [handwritten on green paper]; "TYPE BRUNN" [printed on a strip of white paper]; "Holotypus" [printed on red card]; "Type series unspecified; treat as syntype.

Hollier 2012" [handwritten on red paper]. The species name label in the insect box has the locality "Mexique" handwritten in the lower left corner. Specimen set with wings folded; the left antenna, the last tarsal segment of the left front leg, the tibia and tarsi of the right front leg, both middle legs, the tarsi of the left hind leg and the last tarsal segment of the right hind leg are missing. There is insect feeding damage to the underside of the thorax. Images on OSF. Box B32.

Phylloptera pisifolia Saussure, 1859

regina Saussure, 1859: 207 [*Acanthodis*].

Brasilia, Bahia. Unspecified number of ♂ and ♀.

One ♂ and one ♀, both syntypes. A ♂ with labels: "Bahia" [handwritten on white paper]; "Acanthodis regina, Sss. ♂ n° 68" [handwritten on white paper]; "Platyphyllum consanguineum Serv." [handwritten on green paper]; "Syntypus" [printed on red paper]. Specimen set with wings folded; most of both antennae, the left front leg and both hind legs are lost. The right front leg is detached and secured through the femur on the original pin. There is some mould damage to the specimen. A ♀ with labels: "Bahia" [handwritten on white paper]; "Acanthodis regina, Sss. ♀ n° 67" [handwritten on white paper]; "Platyphyllum consanguineum Serv." [handwritten on green paper]; "Syntypus" [printed on red paper]. Specimen set with right wings spread and left wings folded; most of both antennae, the last tarsal segment of both front legs, the entire left middle leg and two tarsal segments of the right middle leg are missing. Box E17.

A junior synonym of *Leurophyllum consanguineum* (Serville, 1838)

rhombifolia Saussure, 1859: 204 [*Phylloptera*].

[No locality]. Unspecified number of ♂.

There are no specimens under this name in the MHNG. In the original publication the species name is listed but the description is simply "Viridis" and, given that some of the other species are also described as "viridis," the name could be considered a *nomen nudum*. This species was mistakenly synonymised with *Microcentrum laurifolium* L. by Brunner von Wattenwyl (1878: 339) but the specimens placed under that name in the MHNG are either ♀ or collected after the publication of the description and therefore not identifiable as syntypes of *M. rhombifolium* Saussure. Box B35.

Microcentrum rhombifolium (Saussure, 1859)

salicifolia Saussure, 1859: 204 [*Phylloptera*].

Carolina. Unspecified number of ♂.

There are no specimens under this name in the MHNG collections. A ♂ specimen without a locality label placed under the name *Microcentrum retinervis* (Burmeister) could be a syntype of *Phylloptera salicifolia* but this cannot be verified. Box B35.

A junior synonym of *Microcentrum retinerve* (Burmeister, 1838)

sallei Saussure, 1859: 207 [*Conocephalus*].

Mexico. Unspecified number of ♀.

Two ♀ syntypes. A ♀ with labels: "Vera Cruz, t. c." [printed on white card]; "Pyrgocorypha Sallei Sauss. [handwritten on green paper]; "Syntypus" [printed on red paper]. Specimen set with wings folded; both antennae and the left front leg are lost. The specimen has suffered mould damage. A ♀ with labels: "Potrero, Sumichrast" [handwritten on white paper]; "Pyrgocorypha Sallei Sauss." [handwritten on green paper]; "Possible syntype of C. sallaei Sauss. Hollier 2012" [handwritten on red paper]. Specimen set with wings folded. The specimen identified as a possible type by Piotr Naskrecki and illustrated on OSF has a locality label that indicates that it was collected after the publication of the description [Höge collected for Godman and Salvin in the 1870s or 1880s (Papavero & Ibáñez-Bernal, 2003)] and is not a syntype. Box F4.

Pyrgocorypha sallaei (Saussure, 1859)

sallei Saussure, 1859: 210 [*Stenopelmatus*].

Mexico. Unspecified number of ♀.

One ♀ syntype with labels: "74" [handwritten on green paper]; "Stenopelmatus Sallei Sauss." [handwritten on green paper]; "Paratypoid, Stenopelamitus sallaei Sauss." [handwritten by Hubbell on red card with "Paratypoid" printed]; "This adult female will be the new lectotype, D. B. Weissman, 5/1999" [handwritten by Weissman on white card]. The species name label in the insect box has the locality "Mexique" handwritten in the lower left corner. Specimen lacks most of both antennae, the last tarsal segment of the left front leg, the entire right front and middle legs, the tarsi of the left middle leg, the last tarsal segment of the right hind leg and the claws of the left hind leg. There is insect feeding damage to the head. Hubbell has labelled a ♂ specimen placed under this name in the MHNG as lectotype, but the original description only mentions the ♀ and so the identification of this specimen as a syntype is doubtful. Box O1.

Stenopelmatopterus sallaei (Saussure, 1859)

saltator Saussure, 1859: 208 [*Xiphidium*].

Guyana. Unspecified number of ♀.

Lectotype ♀, designated inadvertently by Pitkin (1980: 347), who referred to the specimen as the holotype, with labels: "Xiphidium saltator Sss. Type n° 25" [handwritten on green paper]; "Xiphidium saltator Sauss." [handwritten on green paper]; "Syntypus" [printed on red paper]. Specimen set with wings folded; both antennae, the tarsi of the right front leg, the last tarsal segment of the right hind leg and the entire left hind leg are lost. The specimen has mould damage. The other specimens placed under this name in the MHNG appear to have been collected after the publication of the description and have locality labels for countries other than Guyana. Box F22.

Conocephalus saltator (Saussure, 1859)

salvifolia Saussure, 1859: 204-205 [*Phylloptera*].

Bahia. Unspecified number of ♀.

There are no specimens placed under this name in the MHNG. There are two possible ♀ syntypes of *P. salvifolia* Saussure present under the name *Microcentrum lanceolatum* (Burmeister), although the locality labels give "Pernamb. Brésil" rather than "Bahia". A ♀ with labels: "2 25 Pernamb., Brésil, M De Lessert" [handwritten on ruled white card]; "TYPE BRUNN" [printed on a strip of white card]; "Microcentrum lanceolatum Burm." [handwritten on green paper]; "Possible syntype of *Phylloptera salvifolia* Sauss. Hollier 2012" [handwritten on red paper]. Specimen set with wings folded; the right antenna, the claws of the left front leg, the tarsi of the right front leg and the claws of the left hind leg are missing. The specimen has been re-pinned; the hole left by the original pin can be seen on the prothorax. A ♀ with labels: "2 25 Pernamb., Brésil, M De Lessert" [handwritten on ruled white card]; "TYPE BRUNN" [printed on a strip of white card]; "Microcentrum lanceolatum Burm." [handwritten on green paper]; "Geneva" [typewritten on a strip of yellow paper]; "Possible syntype of *Phylloptera salvifolia* Sauss. Hollier 2012" [handwritten on red paper]. Specimen set with wings folded; the tarsi of the left front leg and left middle leg, the entire right middle leg and the last tarsal segment of both hind legs are missing. Box B35.

A junior synonym of *Microcentrum lanceolatum* (Burmeister, 1838)

sartorianus Saussure, 1859: 211 [*Stenopelmatus*].

Mexico. Unspecified number of ♀.

One ♀ syntype with labels: "Anostosoma Sartorii Sauss, ♀ Tuxtla, M. H. S." [handwritten on whitish paper]; "71" [handwritten on green paper]; "*Stenopelmatus sartorianus* Sauss." [handwritten on green paper]; "Holotypus, *Stenopelmatus sartorianus* Saussure" [handwritten by Hubbell on red card with "Holotypus" printed]. Specimen set with right wings spread and left wings folded; both antennae, the last tarsal segment of the right front leg and the last tarsal segment of the right hind leg are missing. The right middle leg, which lacks the tarsi, is detached and glued along with some dissected mouthparts to a card mount on the original pin. There is another specimen from Tuxtla but this is a ♂ while the original description only treats ♀ characters. The other specimens standing under this name in the MHNG collection were collected after the original description and are therefore not types. Box O1.

Stenopelmatopterus sartorianus (Saussure, 1859)

savignyi Saussure, 1888: 132 [*Saga*].

[Unspecified]. Probably one damaged ♂ (femora missing).

No specimens found in the MHNG. This species was mentioned in the key but there was no description in the

publication. The whereabouts of the type specimen is unknown.

A junior synonym of *Saga ornata* Burmeister, 1838

stenorhinus Saussure, 1899: 620-621, fig. 17 [*Aethiomerus*].

Zanzibar. Unspecified number of ♀.

One ♀ syntype with labels: "Zanzibar, Voeltzkow, 12.9.89" [handwritten on white paper]; "Aethiomerus stenorhinus Sss ♀" [handwritten on white paper]; "Holotypus" [printed on red card]; "Type series unspecified; treat as syntype. Hollier 2012" [handwritten on red paper]. Specimen set with wings folded; two tarsal segments of the left front leg are missing. Both middle legs and the left hind leg (which lacks the last tarsal segment) are detached and secured through the femur on the original pin. Images on OSF. Box F15.

Aethiomerus stenorhinus Saussure, 1899

sumichrasti Saussure, 1859: 210 [*Stenopelmatus*].

Mexico. Unspecified number of ♂.

Three ♂ syntypes. An immature ♂ with labels: "Stenopelmatus Sumichrasti Sss., 72" [handwritten on whitish paper]; "Stenopelmatus Sumichrasti Sauss." [handwritten on green paper]; "Holotypus, Stenopelmatus sumichrasti Sauss, THH" [handwritten by Hubbell on red card with "Holotypus" printed]. Apart from the tips of the antennae the specimen is intact. An immature ♂ with labels: "Vera Cruz, t. c." [printed on white card]; "84" [handwritten on green paper]; "Stenopelmatus Sumichrasti Sauss." [handwritten on green paper]; "Syntypus" [printed on red paper]. Most of both antennae have been lost. An immature ♂ with labels: "Vera Cruz, t. c." [printed on white card]; "85" [handwritten on green paper]; "Stenopelmatus Sumichrasti Sauss." [handwritten on green paper]; "Syntypus" [printed on red paper]. Most of both antennae have been lost. Box O1.

Stenopelmatopterus sumichrasti (Saussure, 1859)

taeniata Saussure, 1898a: 232, 238-239, fig. 17 [*Ephippigera*].

Morocco. Unspecified number of ♂ and ♀.

Lectotype ♂, designated by Nadig (1976: 332), with labels: "620 61 Maroc. M^r Vaucher" [handwritten on ruled white card with "Maroc." printed]; "MAROC" [printed on pink paper]; "Ephippigera taeniata Sss." [handwritten on pink paper]; "Ephippigera taeniata Sauss." [handwritten on blue paper]; "E. taeniata (Sauss.) ♂ det. Nadig" [handwritten on white card with "det. Nadig" printed]; "Lecto-Holo-Typus ♂" [handwritten on red card with "Typus" printed]. The left antenna and the last tarsal segment of both hind legs are lost. The abdomen has been eviscerated and stuffed. Part of the genitalia has been dissected and is glued to a card mount on the original pin. There are six ♂ and eight ♀ paralectotypes with the same data. Images on OSF. Box L5.

Sabaterpia taeniata (Saussure, 1898)

tamerlanus Saussure, 1874: 46-47 [*Decticus*].

Prope Maracandam. Unspecified number of ♂ and ♀. Two ♂ syntypes and two ♀ syntypes. A ♂ with labels: "Decticus Tamerlanus Sss ♂ Turkestan" [handwritten on white paper]; "Platycl. Tamerlanus Sauss. inedit" [handwritten on blue paper]; "Syntypus" [printed on red paper]. A ♂ with labels: "Dourmane 21" [handwritten on white paper]; "Platycl. Tamerlanus Sauss. inedit" [handwritten on blue paper]; "Syntypus" [printed on red paper]. A ♀ with labels: "Vallée de Sarafshan 20" [handwritten on white paper]; "Platycl. Tamerlanus Sauss. inedit" [handwritten on blue paper]; "Syntypus" [printed on red paper]. The last tarsal segment of the right front leg and that of the left middle leg are lost. A ♀ with labels: "Platycl. Tamerlanus Sauss. inedit" [handwritten on blue paper]; "Syntypus" [printed on red paper]. The last tarsal segment of the left middle leg, the tarsi of the left hind leg and two tarsal segments of the right hind leg are lost. The species name label in the insect box has the locality "Turkestan" handwritten in the lower left corner. Box K6.

Semenoviana tamerlana (Saussure, 1874)

tarasca Saussure, 1859: 203-204 [*Phylloptera*].

Mexico, Mechoacan. Unspecified.

Two possible syntypes, both ♀. A ♀ with labels: "Syntechna tarasca Sauss." [handwritten on green paper]; "Holotypus Phylloptera tarasca Sauss." [handwritten by Hubbell on red card with "Holotypus" printed]; "Type series unspecified; treat as syotype. Hollier 2012" [handwritten on red paper]. The species name label in the insect box has the locality "Amer. cent." handwritten in the lower left corner. Specimen set with wings folded; the last tarsal segment of the left front leg and the last tarsal segment of the right middle leg are lost. A ♀ with labels: "Genas, Mexique" [handwritten on white paper]; "Tarasca Sss." [handwritten on a strip of green paper]; "Syntechna" [handwritten on a strip of white paper]; "TYPE BRUNN" [printed on strip of white paper]; "Possible syotype of Phylloptera tarasca Sauss. Hollier 2012" [handwritten on red paper]. Specimen set with wings folded; most of both antennae, the left front leg, the left middle leg and the last tarsal segment of both hind legs are missing. The first specimen, identified as a type by Hubbell, is illustrated on OSF. The seeond was located amongst the specimens in the duplicates box n° 52, where it was apparently not seen by Hubbell, and is more likely to be a syotype. It has now been placed in the main collection. Images on OSF. Boxes B36 & B37.

Syntechna tarasca (Saussure, 1859)

tartara Saussure, 1898a: 226, 227-228 [*Jaquetia*].

Turkestania. Unspecified number of ♂ and ♀.

One ♂ and one ♀, both syntypes. A ♂ with labels: "TURKEST:" [printed on a strip of white paper]; "Jaquetia tartara Sss." [handwritten on blue paper]; "Syntypus" [printed on red paper]. Both antennae and the

left hind leg are missing. A ♀ with labels: "TURKEST:" [printed on a strip of white paper]; "Jaquetia tartara Sss." [handwritten on blue paper]; "Syntypus" [printed on red paper]. Most of both antennae are missing. Bey-Bienko (1954) considered the locality to be erroneous, the species being known only from Western Asia. Box B2.

Isophya tartara (Saussure, 1898)

tartarus Saussure, 1874: 42-43 [*Thamnotrizon*].

Turkestanica. Unspecified number of ♀.

No specimens found in the MHNG. The whereabouts of the type material is unknown.

Pholidoptera tartara (Saussure, 1874)

tessellata Saussure, 1888: 140, 143-144 [*Clonia*].

Afrique méridionale. More than one ♂ (variation of coxal spines mentioned).

Lectotype ♂, designated by Kaltenbach, 1971: 448, with labels: "Cap b Esp," [printed on pink paper]; "Clonia tessellata Sauss." [handwritten on pink paper]; "Clonia (Xanthoclonia) tessellate SAUSS. det. Kaltenbach" [printed on white card]; "Lectotypus" [printed on red card]. Specimen set with wings spread; the right antenna, the tarsi of the right front leg, the tibia and tarsi of the left middle leg, the last tarsal segment of the left hind leg and part of the tibia and the tarsi of the right hind leg are lost. There are two other ♂ with the same label data which are presumably paralectotypes although not labelled as such. The species name is spelled "tessellata" in the key and "tesselata" in the description; Kaltenbach, as the first to revise the species, chose the former spelling. Images on OSF. Box G3.

Clonia tessellata Saussure, 1888

tessellata Saussure, 1861: 129 [*Phylloptera*].

Mexico. Unspecified.

One ♀ syotype with labels: "Phyllopt. marcidi- pent. or." [handwritten on white paper]; "Paragenes tessellata, Sauss." [handwritten on green paper]; "TYPE BRUNN" [printed on a strip of white card]; "Holotypus Phylloptera tessellata Sauss." [handwritten by Hubbell on red card with "Holotypus" printed]; "Type series unspecified; treat as syotype. Hollier 2012" [handwritten on red paper]. Specimen set with wings folded; both antennae, both front legs, the tarsi of the right middle leg, most of the tibia and the tarsi of the left hind leg and the entire right hind leg are missing. There is insect feeding damage to the left hind femur. Images on OSF. Boxes B28 & B29.

Orophus tessellatus tessellatus (Saussure, 1861)

tolteca Saussure, 1859: 206-207 [*Acanthodis*].

Mexico. Unspecified number of ♀.

One ♀ syotype with labels: "Vera Cruz t.c." [printed on white card]; "Acanthodis tolteca Sss. ♀ n° 66" [handwritten on white paper]; "Platyphyllum toltecum Sauss." [handwritten on green paper]; "Syntypus" [printed on red paper]. Specimen set with wings spread;

most of the left antenna, the left front leg, the tarsi of the right front leg and the last tarsal segment of both hind legs are lost. The right middle leg is detached and glued to a card mount on the original pin. There is a ♀ specimen, erroneously referred to as the holotype on OSF, in the MNHN that may be a syntype. Box E18.

Gongrocnemis tolteca (Saussure, 1859)

tolteca Saussure, 1861: 130 [*Anostostoma*].

Mexico, Mons Orizaba (leg. Sallé). Unspecified.

Three ♀ syntypes. A ♀ with labels: "Mexiq." [printed on white card]; "tolteca, tête par devant grossie" [handwritten on bluish paper]; "40" [handwritten on green paper]; "Stenopelmat. talpa Sauss" [handwritten on green paper]; "Lectotypus, Anostostoma tolteca Sauss. THH" [handwritten by Hubbell on red card with "Lectotypus" printed]. Most of the left antenna, the claws of the right middle leg and the last tarsal segment of the right hind leg are lost. A ♀ with labels: "Sta Cruz, Myoapan, près Orizaba, région des pins" [handwritten on white paper]; "87" [handwritten on a square of green paper]; "tolteca Sauss" [handwritten on a strip of green card]; "Stenopelmatus talpa Sauss [sic]" [handwritten on green paper]; "Paratypoid, Anostostoma tolteca Sauss. THH" [handwritten by Hubbell on red card with "Paratypoid" printed]. Specimen lacks the last tarsal segment of the right hind leg. A ♀ with labels: "Anostostoma tolteca Sauss." [handwritten on white paper]; "86" [handwritten on a square of green paper]; "Stenopelmatus talpa Sauss [sic]" [handwritten on green paper]; "Paratypoid, Anostostoma tolteca Sauss. THH" [handwritten by Hubbell on red card with "Paratypoid" printed]. Specimen lacks the last tarsal segment of the right hind leg. There is also a juvenile specimen labelled as a "Paratypoid" by Hubbell, but this was collected at Cordoba by Saussure and it is probably not a syntype. Box O1.

Anostostoma tolteca Saussure, 1861

tolteca Saussure, 1859: 201-202 [*Phaneroptera*].

Mexico. Unspecified number of ♂.

Two ♂ syntypes. A ♂ with labels: "Potrero, Sumichrast" [handwritten on white paper]; "tolteca Sss." [handwritten on green paper]; "TYPE BRUNN" [printed on a strip of white paper]; "Alloty whole Hormilia tolteca Sauss. THH" [handwritten by Hubbell on red card with "Alloty whole" printed]; "Syntypus" [printed on red paper]. Specimen set with wings folded; most of both antennae is missing. A ♂ with labels: "Mexique, Sumichrast" [handwritten on white paper]; "tolteca Sss." [handwritten on green paper]; "TYPE BRUNN" [printed on a strip of white paper]; "Syntypus" [printed on red paper]. Specimen set with wings folded; the left antenna and most of the right antenna and both middle legs are lost. A ♂ specimen without a locality label but with the "tolteca Sss" and "TYPE BRUNN" labels may also be a syntype. Hubbell labelled a ♀ specimen placed under this name as the

holotype, but this is clearly incorrect because the locality label shows that the specimen was collected after the publication of the description [Schumann collected for Godman and Salvin in the 1870s or 1880s (Papavero & Ibáñez-Bernal, 2003)] and the original description does not mention the ♀ or designate a holotype. Images on OSF. Box B20.

Insara tolteca (Saussure, 1859)

tolteca Saussure, 1859: 203 [*Phylloptera*].

Mexico. Unspecified number of ♀.

One possible syntype, a ♂ with labels: "Potrero Sumichrast" [handwritten on white paper]; "Stilpnochlora tolteca, Sauss." [handwritten on green paper]; "Geneva" [typewritten on a strip of yellow paper]; "Probably syntype of tolteca. Emsley 1969" [handwritten in pencil on white card]; Stilpnochlora thoracica (Serville, 1831, Det. M. G. Emsley, 1969) [printed on white card]. Specimen set with left wings spread and right wings folded; the left front leg, the tarsi of the right front leg, the left middle leg and both hind legs are lost. Although Emsley identified this specimen as a possible syntype, only the ♀ is explicitly mentioned in the description and it is probably not part of the type series. Images on OSF. Box B25.

A junior synonym of *Stilpnochlora thoracica* (Serville, 1831)

totonaca Saussure, 1859: 204 [*Phylloptera*].

Mexico. Unspecified number of ♂.

There are no specimens under this name in the MHNG collection. This species was mistakenly synonymised with *Microcentrum retinervis* (Burmeister, 1838) by Brunner von Wattenwyl (1878: 339) and a ♂ specimen without a locality label placed under the latter name could be a syntype of *M. totonacum* Saussure, but this cannot be verified. Box B35.

Microcentrum totonacum (Saussure, 1859)

vaucheriana Saussure, 1898a: 231, 232-233, fig. 12 [*Ephippigera*].

Morocco. Unspecified number of ♂ and ♀.

Seven ♂ and six ♀ syntypes. A ♂ with labels: "MAROC. VAUCHER" [printed on pink paper]; "Ephippigera Vaucheriana Sauss" [handwritten on blue paper]; "Syntypus" [printed on red paper]. Most of the right antenna, and the tibia and tarsi of the left front leg are missing. The abdomen has been eviscerated and stuffed. A ♂ with labels: "620 61 Maroc M^r Vaucher" [handwritten on ruled white card]; "MAROC" [printed on a strip of pink paper]; "Ephippigera Vaucheriana Sauss." [handwritten on blue paper]; "Syntypus" [printed on red paper]. Part of the genitalia has been dissected and is glued to a card mount on the original pin. The abdomen has been eviscerated and stuffed. The dissected genitalia of this specimen are illustrated by Nadig (1994: 992). A ♂ with labels: "620 61 Maroc M^r Vaucher" [handwritten

on ruled white card]; "MAROC. VAUCHER" [printed on pink paper]; "Ephippigera Vaucheriana Sauss" [handwritten on blue paper]; "Syntypus" [printed on red paper]. Most of the left antenna, the tibia and tarsi of the right front leg and the claws of the right middle leg are lost. The abdomen has been eviscerated and stuffed. A ♂ with labels: "620 61 Maroc M^r Vaucher" [handwritten on ruled white card]; "MAROC" [printed on a strip of pink paper]; "Ephippigera Vaucheriana Sauss." [handwritten on blue paper]; "Syntypus" [printed on red paper]. Most of both antennae are lost. The abdomen has been eviscerated and stuffed. A ♂ with labels: "MAROC" [printed on a strip of pink paper]; "Ephippigera Vaucheriana Sauss." [handwritten on blue paper]; "Syntypus" [printed on red paper]. Most of both antennae and the last tarsal segment of the left front leg are missing. The abdomen has been eviscerated and stuffed. A ♂ with labels: "MAROC. VAUCHER" [printed on pink paper]; "Ephippigera Vaucheriana Sauss" [handwritten on blue paper]; "Syntypus" [printed on red paper]. Most of both antennae, the tarsi of the left front leg, two tarsal segments of the right front leg, two tarsal segments of the left middle leg, the claws of the right middle leg and the last tarsal segment of the right hind leg are lost. The abdomen has been eviscerated and stuffed. A ♂ with labels: "620 61 Maroc M^r Vaucher" [handwritten on ruled white card]; "MAROC" [printed on a strip of pink paper]; "Ephippigera Vaucheriana Sauss." [handwritten on blue paper]; "Syntypus" [printed on red paper]. The last tarsal segment of the left front leg is missing. The abdomen has been eviscerated and stuffed. A ♀ with labels: "620 61 Maroc M^r Vaucher" [handwritten on ruled white card]; "MAROC. VAUCHER" [printed on pink paper]; "Ephippigera Vaucheriana Sauss" [handwritten on blue paper]; "Syntypus" [printed on red paper]. Most of both antennae, two tarsal segments of both front legs, the claws of the left middle leg, the tibia and tarsi of the right middle leg and the last tarsal segment of both hind legs are missing. The abdomen has been eviscerated and stuffed. A ♀ with labels: "MAROC" [printed on a strip of pink paper]; "Ephippigera Vaucheriana Sauss." [handwritten on blue paper]; "Syntypus" [printed on red paper]. Most of both antennae, the tarsi of the right front leg and the entire left middle leg are lost. The left hind leg has been reattached with glue and the abdomen has been eviscerated and stuffed. A ♀ with labels: "620 61 Maroc M^r Vaucher" [handwritten on ruled white card]; "MAROC. VAUCHER" [printed on pink paper]; "Ephippigera Vaucheriana Sauss." [handwritten on blue paper]; "Syntypus" [printed on red paper]. Most of both antennae, the last tarsal segment of the left front leg, the claws of the right front leg and the claws of both hind legs are lost. The abdomen has been eviscerated and stuffed. A ♀ with labels: "620 61 Maroc M^r Vaucher" [handwritten on ruled white card]; "MAROC" [printed on a strip of pink paper]; "Ephippigera Vaucheriana Sauss." [handwritten on blue paper]; "Syntypus" [printed

on red paper]. Most of both antennae are missing. The left hind leg, which lacks the claws, is detached and secured through the femur on the original pin. The abdomen has been eviscerated and stuffed. A ♀ with labels: "620 61 Maroc M^r Vaucher" [handwritten on ruled white card]; "MAROC. VAUCHER" [printed on pink paper]; "Ephippigera Vaucheriana Sauss" [handwritten on blue paper]; "Syntypus" [printed on red paper]. The claws of the left hind leg are missing. The abdomen has been eviscerated and stuffed. A ♀ with labels: "620 61 Maroc M^r Vaucher" [handwritten on ruled white card]; "MAROC. VAUCHER" [printed on pink paper]; "Ephippigera Vaucheriana Sauss" [handwritten on blue paper]; "Syntypus" [printed on red paper]. The claws of the right front leg are lost. There are further syntypes in the BMNH and ZMHB according to OSF. Images on OSF. Box L2.

Uromenus vaucherianus (Saussure, 1898)

voeltzkowi Saussure, 1899: 623-624, fig. 20 [*Dicranacrus*].

Madagascar. Unspecified number of ♀.

Two ♀ syntypes. A ♀ with labels: "WEST MADAGASC." [printed on pink paper]; "VOELTZKOW" [printed on a strip of white paper]; "Dicranacrus voeltzkowi Sss. & Bol. [sic] ♀" [handwritten on pink paper]; "Syntypus" [printed on red paper]. The specimen lacks the tarsi of the right front leg. The abdomen and thorax are coming apart because of a build-up of verdigris where the pin is inserted. A ♀ with labels: "WEST MADAGASC." [printed on pink paper]; "VOELTZKOW" [printed on a strip of white paper]; "Dicranacrus voeltzkowi Sss. & Bol. [sic] ♀" [handwritten on pink paper]; "Syntypus" [printed on red paper]. Images on OSF. Box F21.

Dicranacrus voeltzkowi Saussure, 1899

voeltzkowi Saussure, 1899: 619-620, figs 13-16 [*Poascirtus*].

Nossi-Bé. Unspecified number of ♂.

No specimens found in the MHNG. The whereabouts of the type material is unknown.

Poascirtus voeltzkowi Saussure, 1899

zendala Saussure, 1859: 205-206 [*Petaloptera*].

Mexico. Unspecified number of ♀.

Two possible syntypes, both ♀. A ♀ with labels: "Petaloptera zendala, Sauss." [handwritten on green paper]; "TYPE BRUNN" [printed on a strip of white paper]; "Lectotypus Phylloptera zendala Ss. should be designated" [handwritten by Hubbell on red card with "Lectotypus" printed]; "Possible syntype of Petaloptera zendala Sauss. Hollier 2012" [handwritten on red paper]. The species name label in the insect box has the locality "Mexique" handwritten in the lower left corner. Specimen set with wings spread; both antennae, the left front leg, the last tarsal segment of the right front leg, the last tarsal segment of the right middle leg and the

tarsi of both hind legs are missing. There is insect feeding damage to the abdomen. A ♀ with labels: "Petaloptera zendala, Sauss." [handwritten on green paper]; "TYPE BRUNN" [printed on a strip of white paper]; "Possible syntype of Petaloptera zendala Sauss. Hollier 2012" [handwritten on red paper]. Specimen set with wings folded; most of both antennae, the last tarsal segment of both front legs, the last tarsal segment of the left middle leg, the claws of the right middle leg and both hind legs are lost. The specimen is coming apart where the pin is inserted between the pro- and meso-thorax. There are two other ♀ specimens without locality labels that could be syntypes. Images on OSF. Box B36.

Petaloptera zendala Saussure, 1859

zimmermanni Saussure, 1859: 206 [*Platyphyllus*].

Carolina meridionalis. Unspecified number of ♀.

One ♀ syntype with labels: "177" [handwritten on white card]; "Columbia" [handwritten on a strip of white paper]; "Platyphillus zimmermanni Sss. ♀ no 62" [handwritten on pale blue paper]; "Cyrtophyllus perspicillata Fabr." [handwritten on green paper]; "Syntype of P. zimmermanni Sauss. Hollier 2012" [handwritten on red paper]. Specimen set with wings folded; most of both antennae, the last tarsal segment of the left middle leg and the last tarsal segment of both hind legs are missing. There is insect feeding damage to the left wings and abdomen. The "Columbia" label appears to have been added in error. There are two other ♀ specimens with the locality "Etats-Unis" which could also be syntypes. Box E27.

A junior synonym of *Pterophylla camellifolia* (Fabricius, 1775)

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On some hydroids (Cnidaria, Hydrozoa) from the Okinawa Islands, Japan

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Abstract: This paper gives a systematic account of 32 hydroid species identified in a small collection originating from the Okinawa Islands. While most species are well-known from Japanese waters, three new species and five new records for Japan were found. Some not well known species are redescribed. Taxonomically important features of nearly all species are depicted. The new species are: *Schizotricha longinema* new spec., *Cladocarpus unilateralis* new spec., and *Macrorhynchia crestata* new spec. *Zygophylax pacifica* Stechow, 1920 is recognised as a new synonym of *Zygophylax cyathifera* (Allman, 1888). New records for Japanese waters are: *Lytocarpia delicatula*, *Macrorhynchia fulva*, *Caminothujaria molukkana*, *Zygophylax rufa*, *ThyrosCyphus fruticosus*. The presence of *Zygophylax cervicornis* and *Aglaophenia cupressina* in Japanese waters are confirmed by new, fertile material.

Keywords: Leptothecata - Anthoathecata - marine benthic hydroids - Okinawa Islands - Japan - new species.

INTRODUCTION

Japan with its long complex coastline of more than 6000 islands spread over more than 22 degrees of latitudes, ranging from tropical to cool temperate seas, offers a formidable basis for a rich and diverse fauna of marine hydroids.

The first descriptions of hydroids from Japan were most likely published by Allman (1876) who described several Campanulariidae, Bonneviellidae, and Sertulariidae species. Inaba (1890, 1892) then initiated hydroid research in Japan itself and numerous publications by several authors followed. Of particular importance are the studies of Stechow, Jäderholm, Yamada, and Hirohito. A summary of the history on Japanese hydroid research and the pertinent references are given in Hirohito (1988). Most of these studies focused on Honshu and its adjacent islands. The small Okinawa archipelago is the most southerly Japanese prefecture and it belongs to a transition zone to the tropical regions found in the more southerly Philippines (Warm Temperate Northwest Pacific, Spalding *et al.*, 2007). In this region, at least some tropical hydroid species can thus be expected to occur. However, there are only few reports on hydroids from the Okinawa Islands. Yamada & Kubota (1987) provided the only available inventory, while Kubota (1987) and Hirose & Hirose (2012) added further details.

The present report gives an account of 32 species identified in a small collection of hydroids from the Okinawa Islands, mostly from around the islands of Kume and Okinawa. The samples were collected and

kindly given to me by Dr F. Sinniger (Japan Agency for Marine-Earth Science Technology).

MATERIAL AND METHODS

The hydroids were either collected by scuba diving or by dredging using a triangular dredge or a beam trawl. After collection and sorting, they were fixed in absolute ethanol. All samples described here are now in the invertebrate collection of the MHNG.

The specimens were examined with a dissecting microscope or a compound microscope using temporary or permanent preparations on microscope slides (see e. g. Gibbons & Ryland, 1989). Drawings based on material examined for this study and were usually made with the help of a *camera lucida*. The figures given in this publication thus allow making direct measurements of linear dimensions. A few photographs were obtained by combining pictures taken at different focusing levels (focus stacking) using the freely available software PICOLAY created by H. Cypionka (www.picolay.de). Technical terms are generally used as explained in Cornelius (1995a, b), Millard (1975), Schuchert (1996, 2012), or Bouillon *et al.* (2006). The latter publication should also be consulted for genus and family diagnoses which are not given here. If not indicated otherwise, the supraspecific classification follows Schuchert (2015). The synonymy given here is incomplete and includes only the consulted publications. Usually at least one reference is given which has a complete synonymy.

Where possible, parts of colonies were used to extract DNA and to generate 16S sequences using the same techniques as given in Schuchert (2014). The results will be presented in a forthcoming publication.

Abbreviations:

E	East
MHNG	Muséum d'histoire naturelle, Geneva, Switzerland
N	North
NMW	Naturhistorisches Museum Wien, Austria
S	South
SE	south-east
SW	south-west
UUZM	Zoologische Institute, University of Uppsala, Sweden
W	West
ZSM	Zoologische Staatssammlung München, Germany

TAXONOMY

Order Anthoathecata Cornelius, 1992

Family Pennariidae McCrary, 1859

Genus *Pennaria* Goldfuss, 1820

Pennaria disticha Goldfuss, 1820

Pennaria disticha Goldfuss, 1820: 89. – Brinckmann-Voss, 1970: 40, text-figs 43, 45–50. – Gibbons & Ryland, 1989: 387, fig. 5. – Schuchert, 1996: 142, fig. 85a–c. – Schuchert, 2006: 364, fig. 15. – Galea, 2008: 13, fig. 3E. – Calder, 2010: 65, fig. 43. – Calder, 2013: 7, fig. 1A.

Halocordyle disticha. – Millard, 1975: 41, figs 16C–G. – Hirohito, 1977: 2, fig. 1, pls 1–3. – Calder, 1988: 57, figs 43–45, synonymy. – Oestman *et al.*, 1991: 607, figs 1–18. – Hirohito, 1988: 28, figs 9a–d, pl. 1 fig. 1C.

Material: MHNG-INVE-60994; Japan, Okinawa Island, Mizugama, 26.35897°N 127.73856°E, 6 m; 13.05.2008; several infertile plumes, up to 8 cm. – MHNG-INVE-91094; Japan, Okinawa Islands, Okinawa Island, Convention Center, 26.283°N 127.73°E, 8 m; 05.06.2008. – Sample without voucher specimen, material used for DNA extraction; Japan, Okinawa Islands, Okinawa Island, Kin, Red Beach, 26.4453°N 127.9124°E, 8 m; 17.06.2008.

Diagnosis: Hydroid colony pinnate, monosiphonic, hydrocaulus and hydrocladia with terminal hydranths (monopodial); hydranths on short pedicels on upper side of the hydrocladia. Hydranths pear-shaped; tentacles of two types: in distal half of hydranth more or less capitate tentacles in one oral whorl and more in indistinct whorls below, on lower part of hydranth one aboral whorl of semifiliform to slightly capitate aboral tentacles; gonophores developing above aboral tentacles, developing into medusoids which may be liberated or not.

Medusoids elongated; manubrium not extending beyond umbrella margin; gonads completely surrounding manubrium; four radial canals; four permanently rudimentary tentacles, usually reduced to mere bulbs, without ocelli.

Description: See Schuchert (2006).

Type locality: Gulf of Naples (see Calder, 2013).

Distribution: Circumglobal in tropical and warm temperate waters; 0–29 m (Calder, 2010).

Solanderia secunda (Inaba, 1892)

Fig. 1

Dendrocoryne secunda Inaba, 1892: 98, figs 111–113.

Solanderia rufescens Jäderholm, 1896: 5, pl. 1 figs 1–2.

Ceratella minima Hickson, 1903: 114, pl. 13.

Ceratella crosslandi Thornely, 1908: 85.

Solanderia secunda. – Hirohito, 1988: 49, fig. 15. – Bouillon *et al.*, 1992: 12 pls 5–6, 10–12. – Watson, 1999: 13, fig. 9A–F. – Schuchert, 2003: 149, fig. 8. – Kirkendale & Calder, 2003: 164.

Solanderia minima. – Vervoort, 1967: 25, fig. 2, pl. 3 figs 3–4. – Millard & Bouillon, 1973: 16, fig. 2A–B, plate 1. – Millard, 1975: 59, fig. 21C–E.

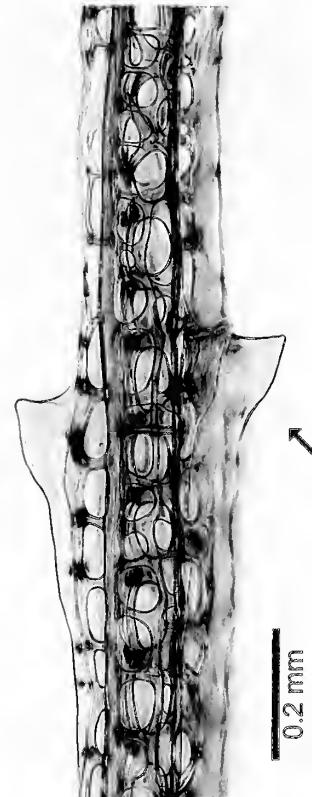


Fig. 1. *Solanderia secunda*, MHNG-INVE-91093, skeleton of terminal branch, soft tissues removed, arrow points at a pair of triangular hydrophores flanking originally a polyp (focus stacking image).

Material: MHNG-INVE-91093; Japan, Okinawa Island, Cape Hedo, 26.8719°N 128.2657°E, 18 m; 22.06.2008; one colony, 12 cm, elongate.

Diagnosis: Solanderiidae species with hydranth bases flanked by two parallel, broadly triangular periderm processes (hydrophores, Fig. 1).

Description: See Bouillon *et al.* (1992), Millard (1975, as *S. minima*), Watson (1999), or Schuchert (2003).

Type locality: Misaki, Japan (Inaba, 1892).

Distribution: Tropical and subtropical Pacific and Indian Ocean, reaching from Japan over Australia to South Africa and the Red Sea.

Family Balellidae Stechow, 1922

Remarks: Nutting (1906: 940) introduced the family name Tubidendriidae for his new genus and species *Balea mirabilis*. Because the genus *Balea* is preoccupied, Stechow (1919: 154) introduced the replacement name *Balella* Stechow, 1919. In order to have a correctly formed family name, Stechow later (1922: 142) also introduced the family replacement name Balellidae (see Calder, 2010).

Affinities and classification of Balellidae are difficult to resolve because the adult medusa of *B. mirabilis* remains unknown. Schuchert (2003), and Nutting (1906) earlier, suggested that affinities of the family were with Hydractiniidae. A preliminary comparison of the 16S sequence of *B. mirabilis* with hydrozoan sequences in the GenBank database (results not shown) clearly clustered it with various *Hydractinia* species. However, more sequences are needed to get a more reliable result (in prep.).

Genus *Balella* Stechow, 1919

Balella mirabilis (Nutting, 1906)

Fig. 2

Balea mirabilis Nutting, 1906: 940, pl. 2 fig. 3, pl. 7 figs 3-4. – Jäderholm, 1919: 4, pl. 1 figs 1-4.

Balella mirabilis. – Stechow, 1923b: 3. – Hirohito, 1988: 91, fig. 32a-c. – Schuchert, 2003: 140, fig. 2. – Calder, 2010: 29, fig. 17.

? *Balea irregularis* Fraser, 1938a: 13, pl. 1 fig. 5. – Calder *et al.*, 2003: 1204, synonym. – Calder *et al.*, 2009: 927, distinct species.

Material: MHNG-INVE-69638; Japan, Okinawa Islands, 26.32253°N 126.74598°E, 62-73 m; 14.11.2009; alcohol preserved 10 cm colony in two pieces, with gonozooids bearing advanced medusa buds; 16S sequence accession number LN810548.

Diagnosis: Hydroid colonies erect, branched, polysiphonic to the branch tips. All superficial tubes

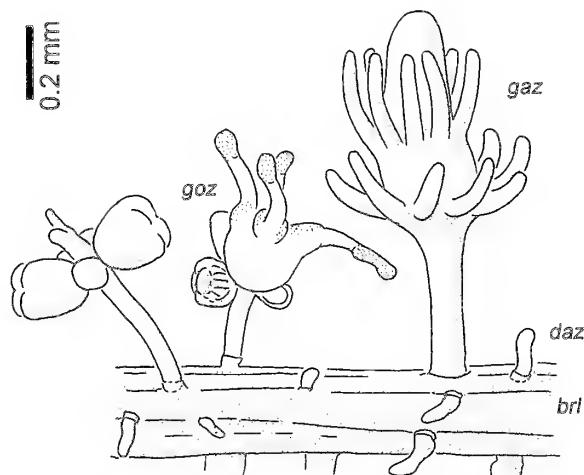


Fig. 2. *Balella mirabilis*, MHNG-INVE-69638, schematised part of branchlet (*brl*) bearing a gastrozooid (*gaz*), dactylozooids (*daz*), and two gonozooids (*goz*). The right gonozooid bears a medusa with its four tentacles everted.

can bear hydranths. Polyps polymorphic. Gastrozooids with club-shaped body and with two well separated whorls of tentacles. Gonozooids with either one tentacle or none, with one whorl of gonophores. Dactylozooids small, tentacle-like. Gonophores released as immature medusae. Young medusa with four filiform tentacles, manubrium simple. Adult medusa unknown.

Description: See Schuchert (2003).

Type locality: Hawaiian Archipelago, between Molokai and Maui, 232 m (Nutting, 1906).

Distribution: Hawaii (Nutting, 1906; Calder, 2010); Japan (Jäderholm, 1919; Hirohito, 1988), Indonesia (Schuchert, 2003); Galapagos Islands (Calder *et al.*, 2003). Depth range 49-538 m (Schuchert, 2003; Calder, 2010).

Remarks: This is a characteristic species and easy to recognise. It is widely distributed in the Pacific, but has not been reported frequently. The medusa buds in the present sample are developed to a point where they could be released (Fig. 2, *goz*). Many had their four tentacles already everted from the subumbrella. The nematocysts of the tentacles are concentrated at the ends, giving the tentacles a slightly capitate appearance. Nutting (1906) states that the branches of the colony are “partly covered with naked coenosarc, which occupies parallel open grooves on the surface.” In the present sample, hand-made cross-sections of branches showed no so naked coenosarc as e. g. in *Hydractinia* species. Perhaps Nutting mistook some adhering dactylozooids for external coenosarc.

The genus *Balella* currently comprises two species, *B. mirabilis* and *B. irregularis* Fraser, 1938. The status of the latter is not entirely clear, but Calder *et al.* (2009),

after re-examination of the type material of *B. irregularis*, recognise both species as valid. In *B. irregularis* from the Galapagos Islands, there are only four short tentacles in the proximal whorl. More samples are needed to confirm if this is a constant difference and not due to environmental influences.

Order Leptothecata Cornelius, 1992
Family Clathrozoidae Stechow, 1921

Remarks: When introducing the new genus *Clathrozoön*, Spencer (1891) also suggested placing it in a new family Hydrocerathinidae. This name is, however, incorrectly formed as it is not based on an existing genus name. Stechow (1921: 251) then introduced the family level names Clathrozoinae and Clathrozoidae. He also included the new genus *Clathrozoella* Stechow, 1921 in this family. The spelling Clathrozonidae used by Hirohito (1967: 1) must be considered a spelling error. Peña Cantero *et al.* (2003) then separated the genus *Clathrozoella* into a new family Clathrozellidae Peña Cantero, Vervoort & Watson, 2003. This family belongs to the Order Anthoathecata, while *Clathrozoön* is clearly a Leptothecata.

Genus *Clathrozoön* Spencer, 1891

***Clathrozoön wilsoni* Spencer, 1891**
 Fig. 3A-H

Clathrozoön wilsoni Spencer, 1891: 123, pls 17-20. – Hirohito, 1967: 6, pls 1-7. – Hirohito, 1995: 8, fig. 1. – Watson, 2005: 503, fig. 38A.

Material: MHNG-INVE-69664; Japan, Okinawa Islands, SE of Kume Island, 26.2838°N 126.86587°E, 126-136 m; 12.11.2009; one fertile colony; 16S sequence accession number LN810549.

Diagnosis: Colony large, much branched, planar, resembling sea-fan. Skeleton a sponge-like periderm derived from coalesced stolon tubes, outside covered by membranous periderm. Hydrothecae arranged spirally on branchlets, almost completely sunken into skeleton of colony, sac-like, curved so that opening nearly parallel to surface, opening closed by conical operculum made of membranous, triangular flaps. Hydranths polymorphic, with gastrozooids, dactylozooids, and nematophores. Dactylozooids very long when extended, with a terminal whorl of capitate tentacles, retractable into hydrothecae identical to those of gastrozooids. Nematocysts tubular, short, arising from membranous cover of colony skeleton. Gonotheca sac-like, often in axils of bifurcating branches, covered by spongy perisarc. Gonophores are free medusoids, no manubrium, with velum, radial canals, eight short tentacles, gonads on radial canals (Hirohito, 1967).

Description: See Hirohito (1967, 1995).

Type locality: Port Phillip Bay, Victoria, Australia (Spencer, 1891).

Distribution: Japan (Hirohito, 1967, 1971, 1995; this study), Australia (Spencer, 1891; Watson, 2005).

Remarks: This is a rather unusual hydroid, its skeleton being very reminiscent of the Solanderiidae (comp. Fig. 1). However, the hydrothecae with an operculum (Fig. 3E) are evidence enough to identify them as Leptothecata. The hydrothecae are almost entirely sunken in a sponge-like lattice (Fig. 3A-E) which is derived from bundled, stolon-like coalesced tubes. Along the surface there are longitudinal ridges (Fig. 3A). Unlike in the Solanderiidae, the surface of the whole colony is covered by a thin, membranous periderm layer (Fig. 3D, F). This membrane is regularly perforated by chimney-like nematocysts (Fig. 3F).

Family Lafoeidae Hincks, 1868
Genus *Acryptolaria* Norman, 1875

Remarks: See Peña Cantero *et al.* (2007) for a recent revision and review of the genus. Descriptions of more species and a key to the species of the western Pacific are given in Peña Cantero & Vervoort (2010).

***Acryptolaria pulchella* (Allman, 1888)**
 Fig. 4A-B

Cryptolaria pulchella Allman, 1888: 40, pl. 19 figs 2 & 2a. – Clarke, 1894: 76. – Nutting, 1906: 947. – Stechow, 1913: 112.

Acryptolaria pulchella. – Peña Cantero *et al.*, 2007: 261, figs 13, 16E, 18E. – Peña Cantero & Vervoort, 2010: 318, figs 26, 30, 32I.

Material: MHNG-INVE-69666; Japan, Okinawa Islands, SE of Kume Island, 26.3283°N 126.71595°E, 93-101 m; 19.11.2009; sterile colony.

Diagnosis: Similar to the well-known *A. conferta* (Allman, 1877), but terminal branches straight and not zig-zag, diameter of hydrotheca larger than 0.23 mm. For more criteria see key in Peña Cantero & Vervoort (2010).

Description: Colony fan-shaped, planar, 7 cm in height, stems and larger branches polysiphonic, monosiphonic branches slightly zig-zag. Hydrothecae alternate, in two opposite rows, in plane of colony. Hydrothecae tubular, about 1 mm long, about 2/3 of adcauline side adnate to branch (in monosiphonic part), evenly curved (ca. 70-80°), basal part somewhat narrowing, no diaphragm, opening circular, diameter 0.32-0.36 mm, renovations of margin frequent. Coenosarc with numerous large nematocysts (4-5)x(16-19)µm. Gonosome not observed.

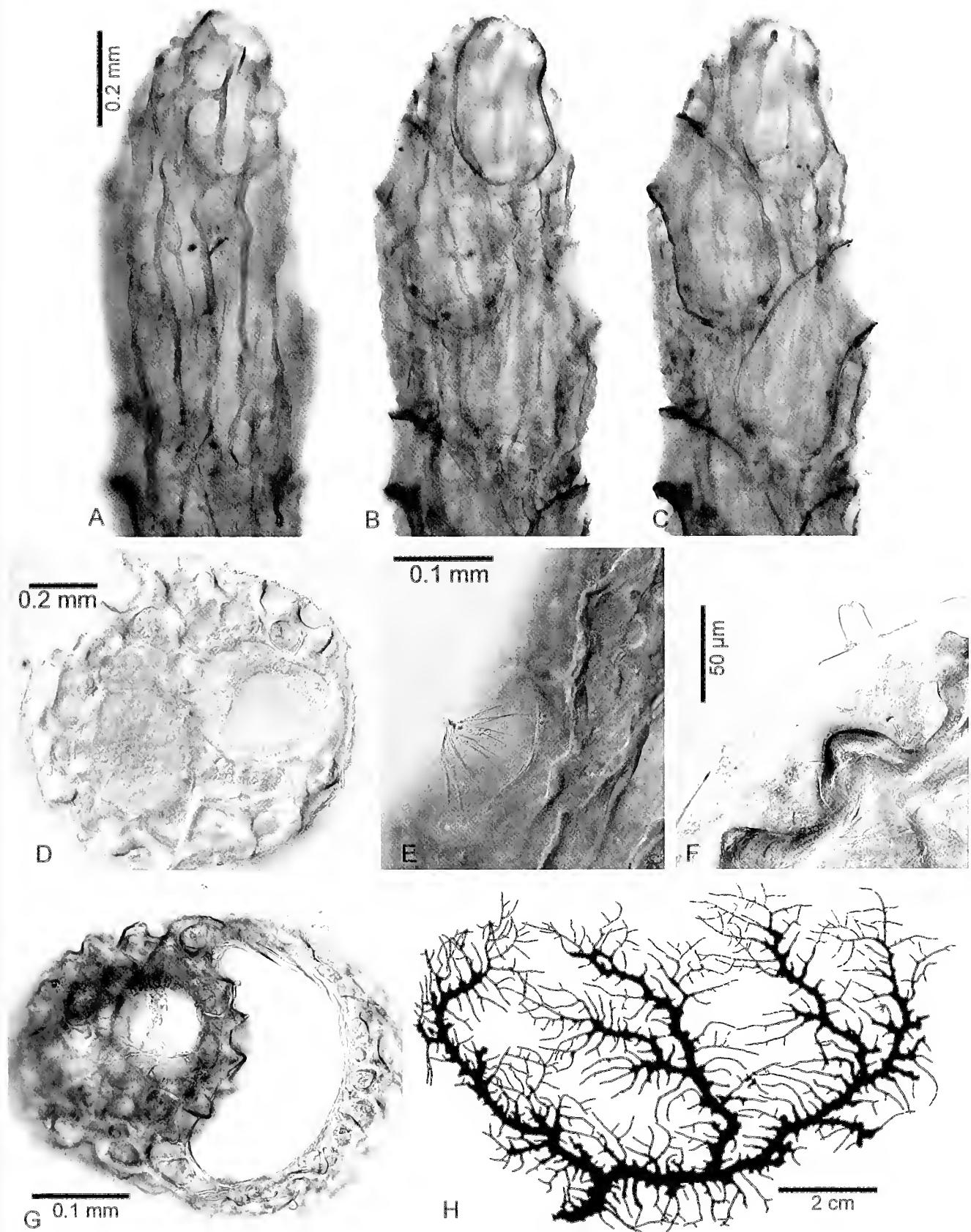


Fig. 3. *Clathrozoon wilsoni*, MHNG-INVE-69664. (A-C) Terminal region of a branch seen in three different focusing planes (surface, subsurface, middle of branch). Hydrothecae are visible in B and C. (D) Cross-section of branch, note membranous layer on surface. (E) Oblique view on branch showing a conical operculum. (F) Higher magnification of cross-section of branch. The outer membrane is somewhat detached and shows a short nematothecae without soft tissue. (G) Cross-section of branch with a gonothece (at right, void). (H) Colony silhouette.

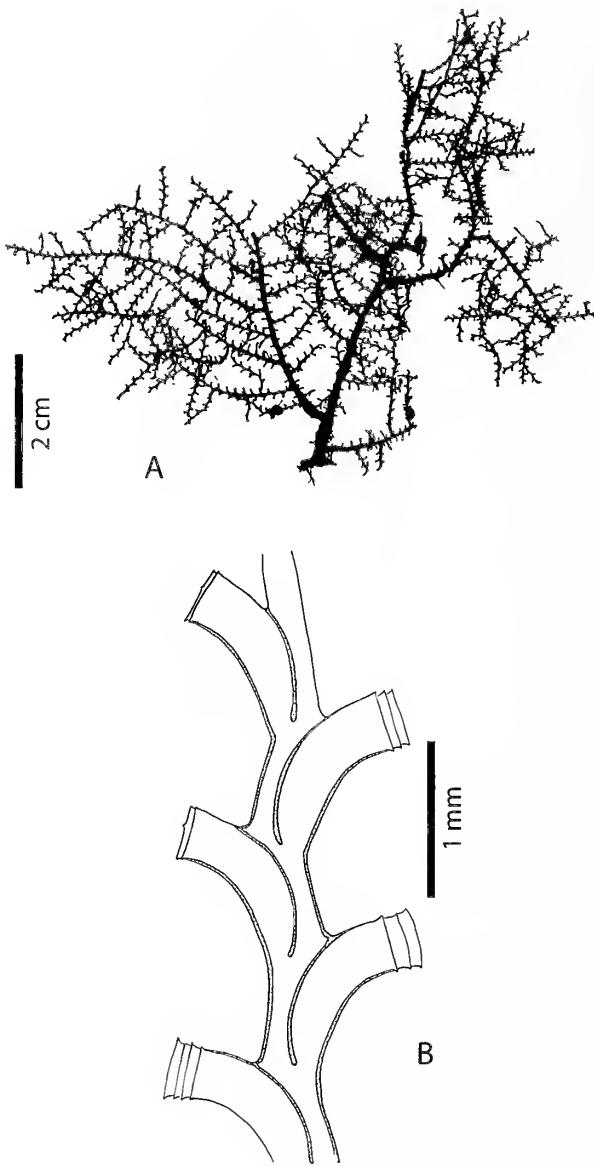


Fig. 4. *Acryptolaria pulchella* MHNG-INVE-69666. (A) Colony silhouette. (B) Monosiphonic part of distal branch.

Type locality: Honolulu, 36-72 m (Allman, 1888).

Distribution: Hawaii (Allman, 1888; Nutting, 1906); Pacific coast of Panama (Clarke, 1894); Sagami Bay, Japan (Stechow, 1913), Philippines (Peña Cantero & Vervort, 2010). Depth range 36-836 m.

Remarks: Peña Cantero & Vervort (2010) described and redescribed numerous *Acryptolaria* species from the western Pacific (New Caledonia to Philippines). The present material from Japan did not match precisely any of their descriptions, although *A. pulchella* comes close. The present colony differed from the type specimen and their Philippine material in having larger diameters of the hydrothecae (0.32-0.36 versus 0.23-0.28 mm) and smaller supplementary nematocysts (16-19 µm versus 20-23 µm). With our current knowledge it is impossible

to decide if these differences represent intraspecific or interspecific differences. I tend more towards the former and because the species has already been reported from Japan by Stechow (1913), the present material was thus identified hesitatingly as *Acryptolaria pulchella* (Allman, 1888).

Genus *Cryptolaria* Busk, 1857

Remarks: See Ralph (1958), Rees & Vervoort (1987), Hirohito (1995), or Vervoort & Watson (2003) for species and details.

Cryptolaria pectinata (Allman, 1888)

Fig. 5A-B

Perisiphonia pectinata Allman, 1888: 45, pl. 21 figs 2, 2a-b. – Pictet & Bedot, 1900: 18, pls 4-5. – Ritchie, 1911: 835, pl. 87 fig. 2.

Perisiphonia chazaliei Versluys, 1899: 32, figs 2-4.

Acryptolaria pectinata. – Stechow, 1925: 448, figs 20-21.

Eucryptolaria pinnata Fraser, 1938b: 140, pl. 20 fig. 9. – Rees & Vervoort, 1987: 50, synonym.

Cryptolaria pectinata. – Ralph, 1958: 320, figs 5g-j & 6g-j. – Millard, 1975: 174, fig. 58A-F. – Rees & Vervoort, 1987: 49. – Ramil & Vervoort, 1992a: 52, fig. 10d. – Hirohito, 1995: 109, fig. 30d-e, pl. 7 fig. A. – Vervoort & Watson, 2003: 54. – Calder, 2013: 20, fig. 5f, taxonomy. *Euperisiphonia rigida* Fraser, 1940: 579, pl. 33 fig. 7. – Calder et al., 2009: 979, synonym.

Material: MHNG-INVE-69654; Japan, Okinawa Islands, SE of Kume Island, 26.2776°N 126.89145°E, 151-160 m; 12.11.2009; one fragmented plume with coppinia.

Diagnosis: *Cryptolaria* species with stem heights reaching 12 cm, with two longitudinal rows of alternate hydrothecae, hydrothecae with distal 1/2 to 1/3 part curved at right angle and protruding out of polysiphonic branches (at least as much as the diameter of hydrotheca), hydrothecal rim often renovated. Nematothecae present on stem and hydrocladial tubes in variable numbers, tubular, with undulated walls.

Gonosome a coppinia, being an oval mass of gonothecae attached around stem or branches. Gonothecae close so that lateral walls adnate (Fig. 5C), elongated bottle-shaped, distally with a shoulder and narrowing into a neck, the latter may be or not drawn out into one or two opposite hood-like structure, opening by means of either a single or two opposed, laterally directed openings. Slender tubes (nematophorous ramuli, Fig. 5D) arise between the gonothecae and project beyond the general surface of the coppinia, the distal free end of these tubes are branched or not, with one or more nematothecae along the branch.

Description: See Ralph (1958) or Hirohito (1995) for illustrations and detailed descriptions. Diameters of

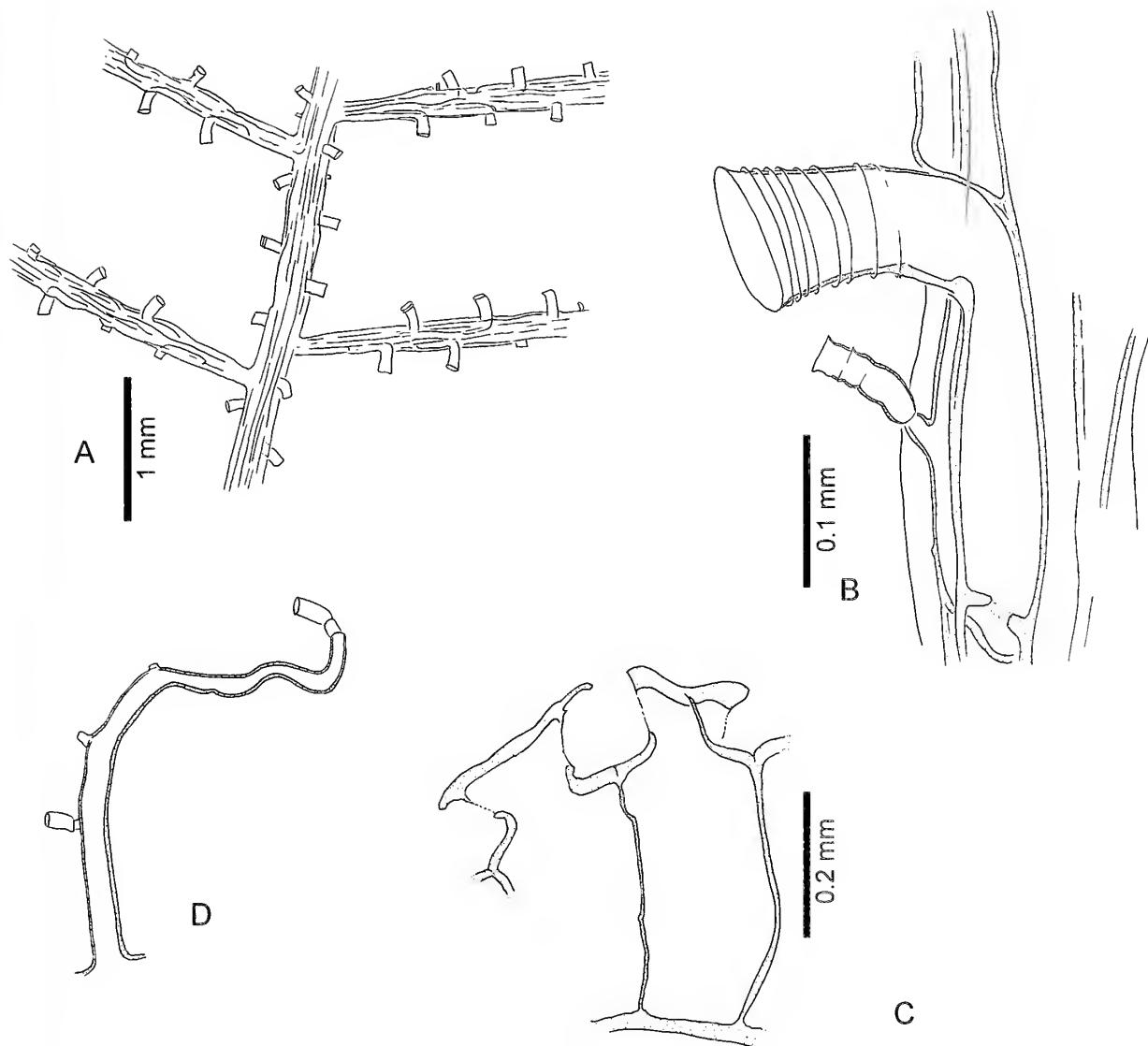


Fig. 5. *Cryptolaria pectinata*, MHNG-INVE-69627. (A) Part of stem and hydrocladia. (B) Hydrotheca and nematotheca. (C) Vertical section through coppinia showing one complete (right) and one incomplete gonotheca (left). (D) Protective ramule of coppinia, same scale as C.

hydrothecae in present material about 80 µm, spacing of hydrothecae in one row about 0.5 mm, gonothecae 0.45 mm high, with two pointed processes, the whole neck region resembling the form of an anvil (Fig. 5C).

Type locality: New Zealand, off East Cape, 37.5667°S 179.3667°E, depth 1278 m (Allman, 1888).

Distribution: The geographical distribution includes areas in the Atlantic-, Indian-, and Pacific Oceans in depths of 49–1280 m (Vervoort & Watson, 2003).

Remarks: The present material matched well the description given by Hirohito (1995), except that there were fewer nematothecae. Their number is variable (Vervoort & Watson, 2003) and of no systematic importance.

Ralph (1958) depicts gonothecae from the type specimen

which have their distal region drawn out into a hood-like structure with an opening at its base. Stechow (1925), having material from the north-eastern Atlantic, observed two types of gonothecae: either with one pointed process or with two. His conclusion that this reflects a sexual dimorphism, with the latter form being females, was refuted by Ralph (1958). The present material had processes with two points, the whole neck region resembling the form of an anvil, conforming to the observations of Millard (1975) and Hirohito (1995). Nematophorous ramules are also present in the material from Okinawa. Calder *et al.* (2009) found them lacking in the type material of *Euperisiphonia rigida* Fraser, 1940, which Calder *et al.* (2009) consider conspecific with *C. pectinata*.

Genus *Lafoea* Lamouroux, 1821

Lafoea dumosa (Fleming, 1820)

Fig. 6A-B

Sertularia dumosa Fleming, 1820: 84.

Lafoea dumosa. — Cornelius, 1975: 385, fig. 4, synonymy. — Cornelius, 1995a: 261, fig. 60. — Hirohito, 1995: 126, fig. 36a-c, pl. 8 fig. A. — Schuchert, 2001: 67, fig. 54A-D.

Material: MHNG-INVE-69627; Japan, Okinawa Islands, SE of Kume Island, 26.2451°N 126.85728°E, 179-192 m; 20.11.2009; sterile colony. — MHNG-INVE-69652; Japan, Okinawa Islands, SE of Kume Island, 26.2624°N 126.857°E, 150-168 m; 12.11.2009; sterile colony.

Diagnosis: *Lafoea* forming erect, polysiphonic colonies, hydrothecae 0.5-0.6 mm in height (valid for Japanese waters only).

Description: See Cornelius (1995a).

Type locality: Arboath, Angus, Scotland (Cornelius, 1975).

Distribution: Near-cosmopolitan, being widely distributed in Atlantic, Pacific, and Indian Oceans, penetrating both in Arctic and Antarctic regions (Vervoort & Watson, 2003).

Remarks: The two examined colonies had hydrothecae with a more or less distinct pedicel (Fig. 6A-B) and they also possessed large type (22 µm) of nematocysts. Schuchert (2001) found that the presence of a pedicel correlates with the large type of nematocysts (>21 µm), while colonies with sessile hydrothecae had usually

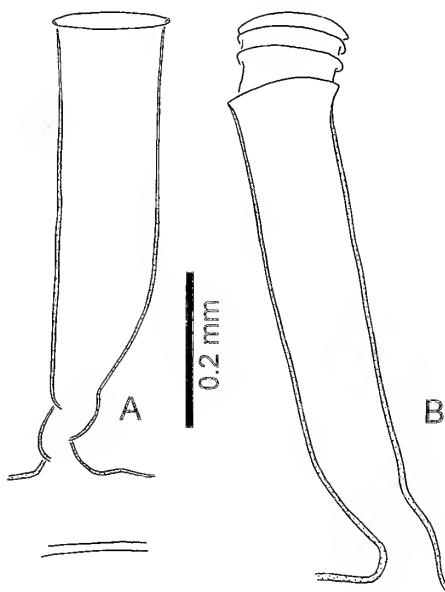


Fig. 6. *Lafoea dumosa*, hydrothecae. (A) MHNG-INVE-69652. (B) MHNG-INVE-69627.

smaller nematocysts (< 16 µm). This is a strong indication that two separate species are involved. Preliminary molecular data (Moura *et al.*, 2011) confirmed this idea and more studies are clearly needed to disentangle the complex situation of the numerous nominal *Lafoea* species.

Genus *Zygophylax* Quelch, 1885

Remarks: Although most species of this genus have been redescribed or revised (e. g. Cornelius, 1975; Hirohito, 1995; Rees & Vervoort, 1987; Antsulevich, 1988; Gibbons & Ryland, 1989; Ramil & Vervoort, 1992a; Altuna Prados & Alvarez-Claudio, 1994; Vervoort & Watson, 2003; Schuchert, 2003; Calder *et al.*, 2009; Altuna, 2012), many species remain difficult to distinguish and a comprehensive, worldwide revision using morphological and molecular data is needed. Most species are only reliably identifiable when fertile, as the coppinia offer often the only distinctive characters.

Zygophylax cervicornis (Nutting, 1906)

Fig. 7A-H

Lictorella cervicornis Nutting, 1906: 946, pl. 4 fig. 1, pl. 10 figs 5-9.

Not *Lictorella cervicornis*. — Fraser, 1918: 134, pl. 2 fig. 3. — Fraser, 1937: 123, pl. 26 fig. 141. [= *Z. convallaria*] *Zygophylax cervicornis*. — Jäderholm, 1919: 10. — Leloup, 1938: 10. — Rees & Vervoort, 1987: 69. — ? Vervoort & Watson, 2003: 72, fig. 10D-F.

Not *Zygophylax cervicornis*. — Hirohito, 1983: 28-29, fig. 9. [= *Z. convallaria*, see Hirohito, 1995]

Material: MHNG-INVE-69625; Japan, Okinawa Islands, S of Kume Island, 26.2454°N 126.8174°E, 141-165 m; 20.11.2009; fertile colony, likely female. — MHNG-INVE-69628; Japan, Okinawa Islands, S of Kume Island, 26.2451°N 126.8573°E, 179-192 m; 20.11.2009; sterile.

Diagnosis: *Zygophylax* forming much branched colonies reaching 10 cm in height, stem and hydrocladia bases polysiphonic, perisarc of stem and branches pale yellow.

Hydrotheca slender, deeply campanulate, about three times as long as wide, slightly curved, pedicel separated from apophysis by distinct node. Nematothecae variably present on apophyses of hydrothecae, short, barrel-shaped. Gonothecae in coppinia, loosely aggregated and not in contact with each other, numerous protective branches which branch and coalesce profusely, thus forming a dense, three-dimensional lattice over the gonothecae. Gonothecae with irregular shape, approximately an inverted cone, 2-3 subterminal openings directed sideways, opening mostly not on tubular necks, sometimes on broad and short tubular extensions.

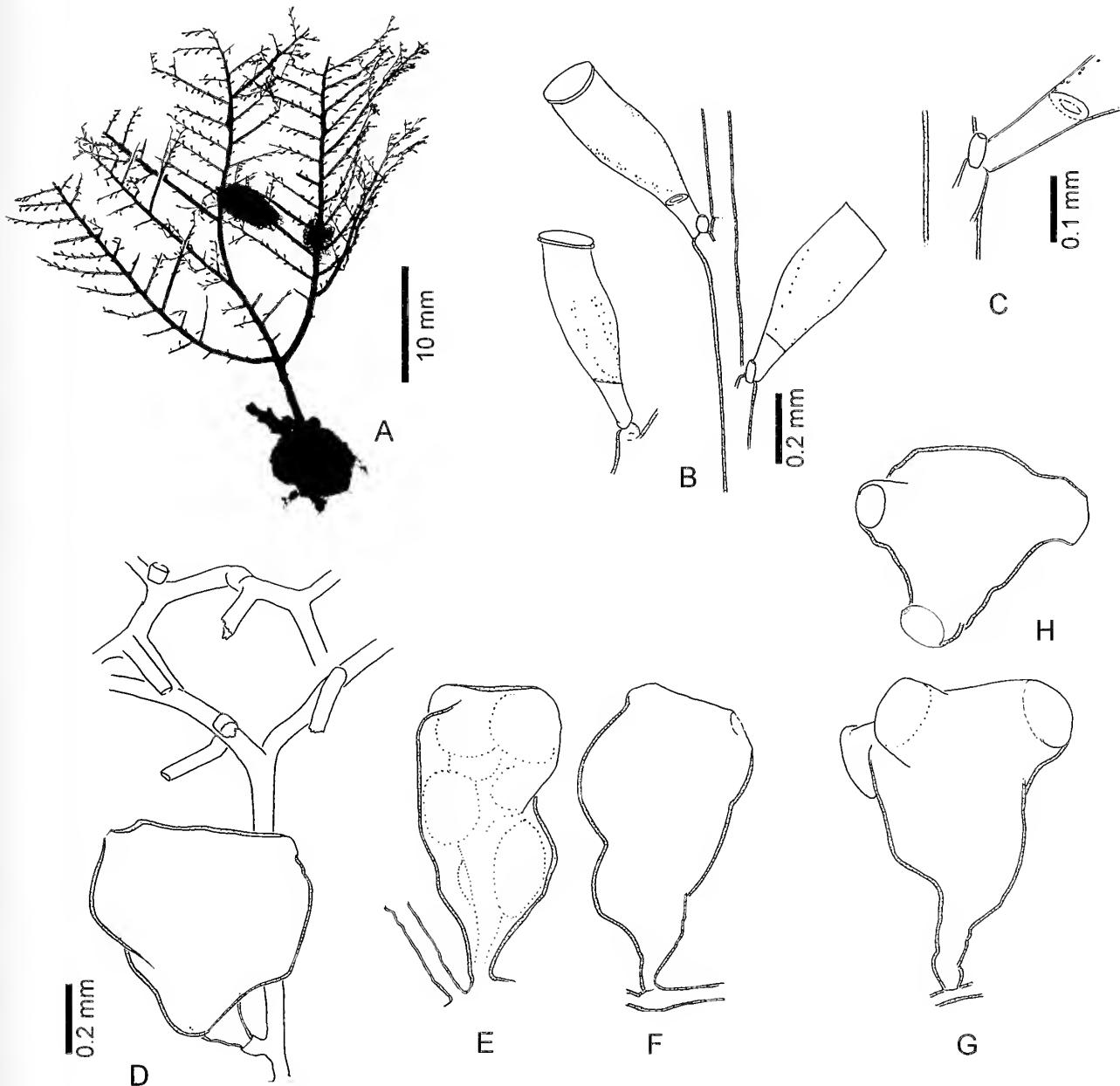


Fig. 7. *Zygophylax cervicornis*, MHNG-INVE-69625. (A) Colony silhouette. (B) Hydrothecae from the hydrocladia, note the two rows of perisarc dots. (C) Apophysis with nematotheca and pedicel of hydrotheca. (D) Gonotheca and some protective tubules. (E-F) Typical gonothecae in lateral view, in E the outline of the soft tissue is shown. (G) Gonotheca with openings on short, thick necks, lateral view. (H) Same gonotheca as in G in axial view from above.

Description (Okinawa material): Colonies erect, pinnate, up 9 cm (Fig. 7A); stems branching extensively in roughly one plane, thick, polysiphonic, bearing two rows of branches (hydrocladia). Perisarc of stem thick and firm, horny brown-yellow in colour.

Stem composed of an axial tube and several parallel accessory tubes, all without distinct nodes, apophyses of hydrothecae hidden by accessory tubes, stem hydrothecae often lost.

Hydrocladia subopposite, often not clearly distinguishable

from branched stem, polysiphonic except towards the ends. Hydrothecae of hydrocladia alternate, in two rows, not in the same plane as the branched stem but directed obliquely in relation to stem plane.

Basal part of hydrotheca separated from apophysis by distinct node (Fig. 7C). Hydrotheca deeply campanulate, rather elongate, about three times as long as wide, depth from diaphragm to rim 0.45-0.6 mm, gently curved, sometimes with S-like curvature (Fig. 7B) or straight, diaphragm with large, circular opening. Pedicel (basal

node to diaphragm) about 1/5 of total height. Perisarc of hydrotheca firm, gradually thinning out along hydrothecal wall. Hydrotheal aperture circular, slightly everted and often with 1-3 renovations. On inside of hydrotheca two irregular rows of dot-like perisarc thickenings (desmocytes) (Fig. 7B).

One nematotheca on most apophyses bearing the hydrothecae (Fig. 7C), often missing (lost?). Nematothecae small, lateral walls bulging and thus barrel-shaped, with circular opening, perisarc very thin. Gonothecae in coppiniae wrapping the stem (Fig. 7A), loosely aggregated and not in contact with each other, arising from thin tubules. Coppinia with numerous additional protective tubules which branch and coalesce profusely, thus forming a dense, three-dimensional lattice over the gonothecae, nematothecae not apparent. Gonothecae with irregular shape, approximating an inverted triangle (Fig. 7D-G), 2-3 openings subterminal and directed sideways, opening mostly not on tubular necks, sometimes on broad and short tubular extension (Fig. 7G-H). Female gonothecae with up to eight eggs or embryos.

In addition to the small (ca. 6 µm) tentacular nematocysts, there are a few large, oval nematocysts of 16-18 µm length.

Type locality: Between Islands of Molokai and Maui, Hawaii, 21.0444°N 156.739°W, 252-256 m (Nutting, 1906).

Distribution: Hawaii, Japan, New Zealand (Vervoort & Watson, 2003).

Remarks: *Zygophylax cervicornis* has been reported several times for Japan (Jäderholm, 1919; Leloup, 1938; Hirohito, 1983) and the Pacific coast of North America (Fraser, 1918, 1937). However, all these records were based on infertile material and hence these identifications must be considered doubtful. Hirohito (1983) mentions that he had seen fertile material from Sagami Bay, which, however, had gonothecae that differed from Nutting's (1906) *Z. cervicornis*. Later, Hirohito (1995) identified this material as *Z. convallaria* (Allman, 1877). Following Hirohito, Vervoort & Watson (2003) then referred all these former records to *Z. convallaria*. *Zygophylax cervicornis* and *Z. convallaria* are very similar and Vervoort (1972) synonymised the two names. Later, Rees & Vervoort (1987) kept them distinct again and also Hirohito (1995) regarded them as distinct. *Zygophylax cervicornis* has rather distinct gonothecae (Fig. 7D-F) lacking the relatively long horizontal necks of *Z. convallaria* (see Vervoort, 1972 and Hirohito, 1995 for a description of *Z. convallaria*). Only sometimes there are thick, short necks present as shown in Fig. 7G-H. Another difference is found in the protective tubules of the coppinia: they are sparse in *Z. convallaria* and very much developed in *Z. cervicornis*. The present material

agrees rather well with Nutting's (1906) description of both the trophosome and the gonosome.

The two rows of perisarc dots along the inside of the hydrotheca have not been reported by other observers and could be a unique feature. They are only visible in specimens which have been cleaned by digesting the soft tissues with a proteinase (as used for DNA extractions).

Zygophylax cyathifera (Allman, 1888)

Fig. 8A-B

Lictorella cyathifera Allman, 1888: 36, pl. 11 figs 3 & 3a. – Billard, 1910: 7, fig. 2.

Zygophylax cyathifera. – Rees & Vervoort, 1987: 62, figs 11 & 12a-c.

Zygophylax biarmata. – Stechow, 1913: 114, fig. 88. [not *Zygophylax biarmata* Billard, 1905]

Zygophylax pacifica Stechow, 1920: 19. new synonym

Zygophylax pacifica. – Stechow, 1923c: 141. – Leloup, 1938: 10. – Vervoort, 1941: 198. – Rees & Vervoort, 1987: 74. – Hirohito, 1983: 29, fig. 10. – Hirohito, 1995: 142, fig. 43e-f, pl. 9 fig. B.

Material: MHNG-INVE-69626; Japan, Okinawa Islands, S of Kume Island, 26.2451°N 126.85728°E, 179-192 m; 20.11.2009; fertile colony. – MHNG-INVE-69648; Japan, Okinawa Islands, S of Kume Island, 26.2624°N 126.857°E, 150-168 m; 12.11.2009; fertile colony. – MHNG-INVE-69655; Japan, Okinawa Islands, SE of Kume Island, 26.2776°N 126.89145°E, 151-160 m; 12.11.2009; fertile colony.

Diagnosis: *Zygophylax* species with pinnate colonies reaching 10 cm in height, stem may be branched, polysiphonic, hydrocladia usually monosiphonic, perisarc of stem and branches pale yellow. Hydrotheca campanulate, about 0.45 mm deep, pedicel and apophysis without distinct node separating them. Nematothecae variably present on apophyses of hydrothecae, short, tubular. Gonothecae densely packed in coppiniae and contiguous, bottle-shaped, widening from base onward, opening on a distinct neck (1/4 of total height), neck straight or curved, sometimes hood-like. No protective tubules. Large (30 µm) macrobasic euryteles present in polyps and coenosarc.

Description (Okinawa material): Colonies erect, pinnate (Fig. 8A), up to 7 cm; individual plume with distinct, straight stem bearing two rows of branches (hydrocladia) in one plane, all hydrothecae also in same plane. Perisarc of stem thick and firm, horny brown-yellow in colour, that of peripheral tubules much thinner.

Stem composed of axial tube and several parallel accessory tubes, all without distinct nodes. Two types of apophyses on axis, those bearing hydrocladia and others supporting axial hydrothecae. Stem apophyses supporting hydrocladia sub-opposite; two stem hydrothecae between each pair of hydrocladial apophyses, stem apophyses with

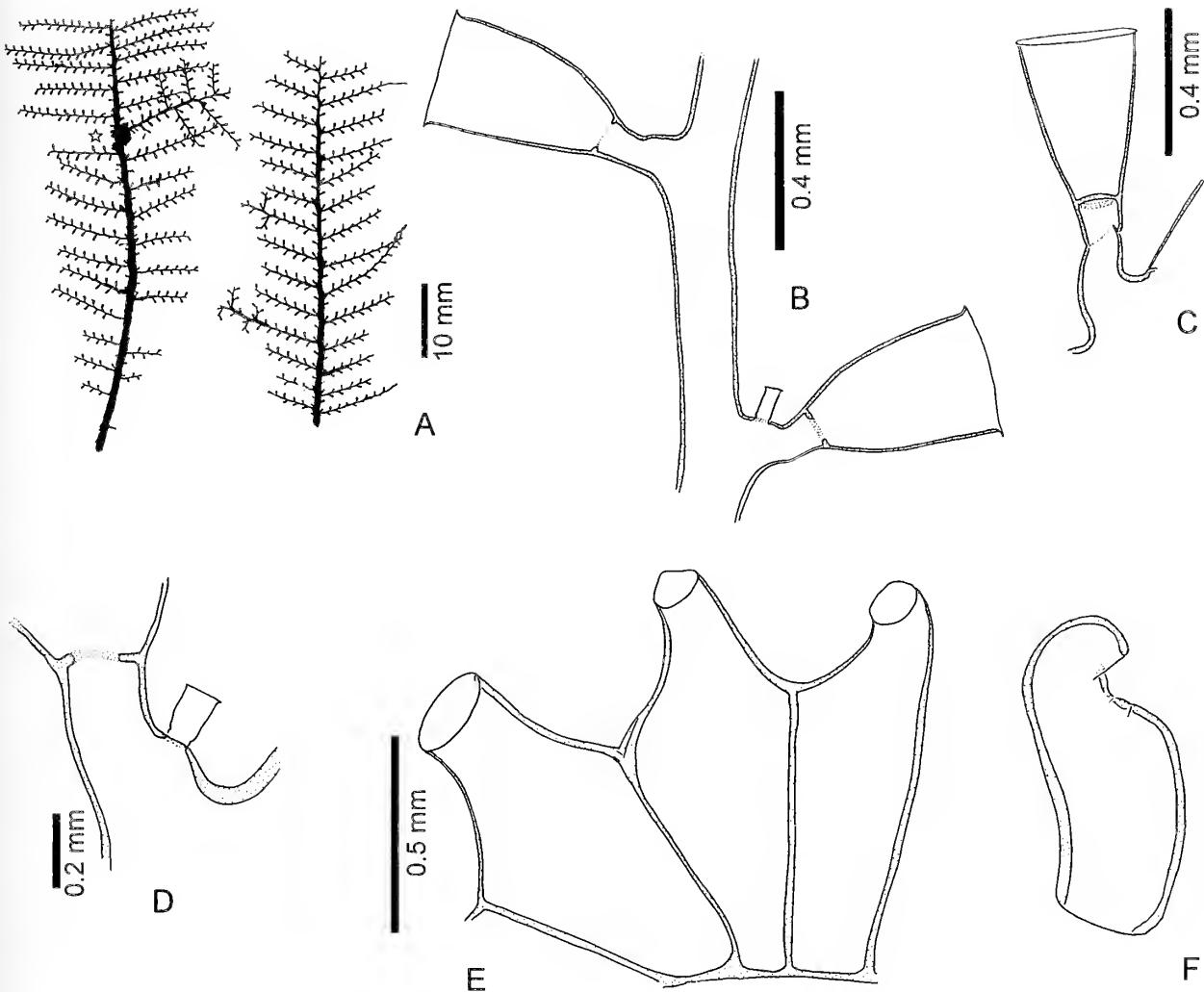


Fig. 8. *Zygophylax cyathifera*. (A) Silhouettes of two colonies, note the coppinia (star), MHNG-INVE-69626. (B) Two hydrothecae of hydrocladium, MHNG-INVE-69648. (C) Hydrotheca with indistinct node separating it from apophysis, MHNG-INVE-69655. (D) Apophysis with nematotheca and base of hydrotheca, MHNG-INVE-69655. (E) Optical section of part of coppinia showing three adnate gonothecae, MHNG-INVE-69655. (F) Isolated gonotheca with strongly curved neck part (opening), same scale as E, MHNG-INVE-69648.

axillary hydrothecae and 0-2 nematothecae (some lost during collection). Main axial tube and accessory tubes may occasionally bear nematothecae. Stem hydrothecae in two opposite rows, alternating in position.

Hydrocladia subopposite, up to 12 mm long, bearing up to 28 hydrothecae, mostly monosiphonic, occasionally with an auxiliary tube, occasionally hydrocladia branched (Fig. 8A). Hydrothecae of hydrocladia alternate, in two opposite rows, all in same plane.

Basal part of hydrotheca not separated from apophysis by distinct node or occasionally by indistinct one (Fig. 8C). Hydrotheca campanulate, nearly symmetrical, less than two times as long as wide, depth from diaphragm 0.45 mm, diaphragm with large, circular opening. Perisarc of hydrotheca firm, gradually thinning out along hydrothecal wall. Hydrothecal aperture circular, slightly

everted and often with 1-3 renovations. One nematotheca on most apophyses bearing the hydrothecae (Fig. 8B), often missing (lost?). Nematothecae small (Fig. 8D), cup-shaped, with circular, slightly everted rim and slightly bulging, almost parallel walls; perisarc very thin. Gonothecae aggregated into coppinia encircling the stem (Fig. 8A), protective branchees and nematotheiae absent. Gonothecae tightly packed, adnate and lateral walls partially fused. Individual gonotheca bottle-shaped (Fig. 8E-F), with distally widening body turning into tubular neck with a terminal opening, neck about 1/4 of total height, straight or curved, occasionally even curved for more than 90° (Fig. 8F).

The hydranths and the coenosarc contain conspicuous, very large (30 µm) macrobasic euryteles, this in addition to the small nematocyst found on the tentacles.

Type localities: *Zygophylax cyathifera*, Vanuatu, Epi Island, 16.75°S 168.12°E 115-237 m (Allman, 1888). *Zygophylax pacifica*, Japan, Sagami Bay, Okinose Bank, 34.9535°N 139.2760°E, depth 250 m (Ruthensteiner *et al.*, 2008).

Distribution: Vanuatu Islands (Allman, 1888), Zanzibar and South Africa (Rees & Vervoort, 1987), Philippines (Vervoort, 1941, as *Z. pacifica*), Japan, from Sagami Bay to Okinawa Islands (Hirohito, 1995; this study).

Remarks: The present material fits very well the description of Stechow (1923c) and Hirohito (1995) for the Japanese *Z. pacifica*. However, there is nothing that would allow to separate this species reliably from *Z. cyathifera* (Allman, 1888) described by Rees & Vervoort (1987) using the type material of the species. The only difference is that in *Z. cyathifera* the basal part of hydrotheca is separated from the apophysis by a distinct node. While such a node is absent or at best indistinct in the present material, it is certainly not a character suitable for a species distinction. *Zygophylax pacifica* (Stechow, 1920) is therefore regarded as not distinguishable from *Z. cyathifera* and the former name becomes a junior synonym of the latter. The type material of *Z. cyathifera* was collected in the Vanuatu Islands (then New Hebrides), which is from a biogeographic point of view rather close to the type locality of *Z. pacifica* (Sagmai Bay, Japan).

Zygophylax cyathifera resembles very much *Z. biarmata* (Ramil & Vervoort, 1992a), but the latter has often two nematothecae at the base of the hydrothecae and, more importantly, the coppinia have protective tubules and the gonothecae are not adnate. As already pointed out by Ramil & Vervoort (1992a), the Japanese material

identified by Hirohito (1983, 1995) as *Z. biarmata* unlikely belongs to this species as the gonothecae have 2-3 long, horizontal horn-like processes. The same is also true for the Korean *Z. biarmata* described by Park (2010). This Pacific *Zygophylax* material belongs likely a yet unnamed species.

Zygophylax rufa (Bale, 1884) is also deceptively similar to *Z. cyathifera*, but has characteristically red colonies, the necks of the gonothecae are always strongly recurved and look hood-like, and there are nematothecae at the bases of the gonothecae (Fig. 9D).

Zygophylax rufa (Bale, 1884)

Fig. 9A-D

Campanularia rufa Bale, 1884: 54, pl. 1 fig. 1.

Lictorella rufa. – in part Vervoort & Vasseur, 1977: 15, figs 5-8.

– Gibbons & Ryland, 1989: 395: fig. 15.

Zygophylax rufa. – Rees & Vervoort, 1987: 55. – Schuchert, 2003: 159, fig. 18.

? *Zygophylax antipathes*. – Hirohito, 1983: 24, fig. 7. [not *Zygophylax antipathes* (Lamarck, 1816)]

Material: MHNG-INVE-60995; Japan, Okinawa Island, Mizugama 26.35897°N 127.7386°E, 4 m; 13.05.2008; three pinnate stems including hydrorhiza, up to 4 cm high, one stem with aggregated female gonothecae, each containing one egg/embryo.

Diagnosis: *Zygophylax* species with stem and branches reddish-purple to mahogany coloured, stem polysiphonic, not much branched, hydrocladia pinnately arranged and not around the stem, more or less alternate. Hydrotheca campanulate, about 0.3-0.4 mm deep, pedicel with or without node. Nematothecae

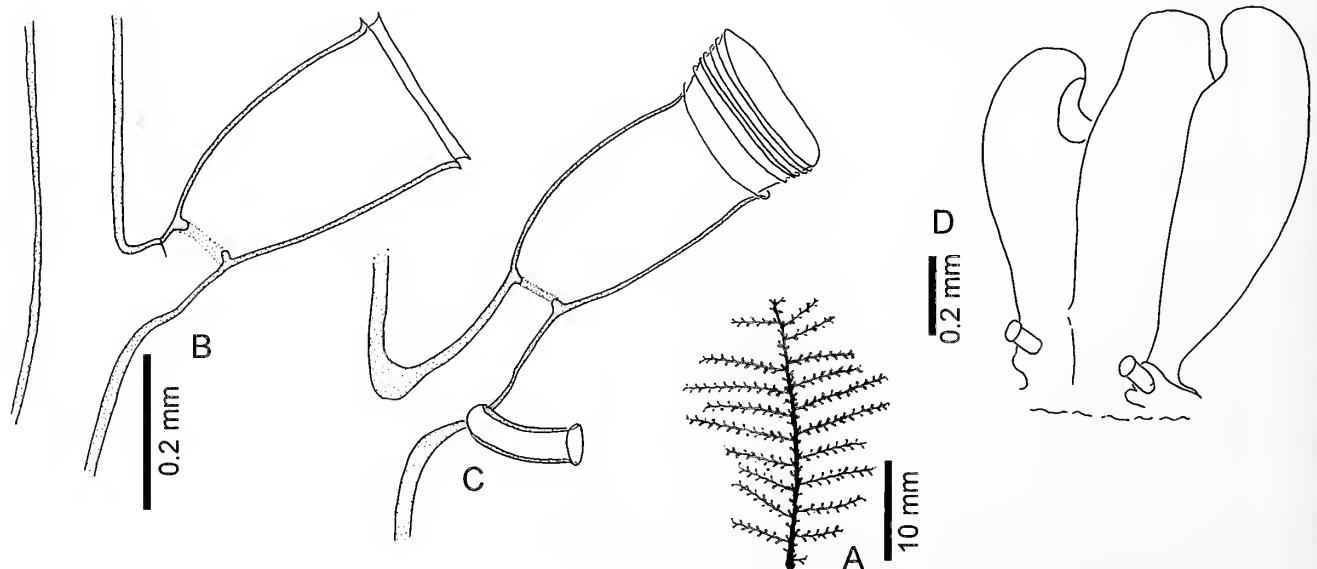


Fig. 9. *Zygophylax rufa*, MHNG-INVE-60995. (A) Silhouette of a stem. (B-C) Hydrothecae, note renovations of rim and nematotheca on pedicel of hydrotheca at right. (D) Group of three gonothecae, note nematothecae at base.

infrequent, on pedicels/apophyses of hydrothecae, tubular. Gonothecae in coppinia, densely packed and contiguous, slightly widening from base onward, near apex suddenly narrowed into hooded structure with rounded top, with lateral opening. Nematothecae are present at the bases of the gonothecae (Fig. 9D). One egg/embryo per gonotheca.

Description: See Vervoort & Vasseur (1977), Gibbons & Ryland (1989), or Schuchert (2003).

Type locality: Australia, Great Barrier Reef, Holborne Island (Bale, 1884).

Distribution: Great Barrier Reef, French Polynesia, Fiji Islands, Kei Islands, Okinawa Islands.

Remarks: *Zygophylax rufa* and *Z. antipathes* (Lamarck, 1816) are very similar (see discussions in Watson, 1973; Vervoort & Vasseur, 1977; Schuchert, 2003). The present material was identified as *Z. rufa* because it had pinnate stems with hydrocladia in one plane (Fig. 9A) and a purple perisarc.

The nematothecae at the base of the gonothecae have not been noted so far, but only few coppinia of this species have been described (Vervoort & Vasseur, 1977; Gibbons & Ryland, 1989).

This is the first record of this species for Japan, but the doubtful record of *Z. antipathes* by Hirohito (1983) may actually have been *Z. rufa* because the stem heights of 4 cm and the strictly pinnate hydrocladial arrangement are more characteristic for the latter species. See also the remarks under *Z. cyathifera*.

Zygophylax sibogae Billard, 1918

Fig. 10A-B

Zygophylax sibogae Billard, 1918: 21, fig. 1. – in part Totton, 1930: 167, fig. 21. – Ralph, 1958: 311, fig. 2e-i. – Millard, 1975: 198, fig. 65A-C. – Rees & Vervoort, 1987: 72. – Hirohito, 1995: 144, fig. 45a-d, pl. 9 fig. D. – Watson & Vervoort, 2001: 159, fig. 5a-d. – Vervoort & Watson, 2003: 80, figs 13G-K, 14A-B. – Schuchert, 2003: 160, fig. 19. – Vervoort, 2006: 247, fig. 19b-c.

Material: MHNG-INVE-69633; Japan, Okinawa Islands, N of Kume Island, 26.3932°N 126.7535°E, 95.5-123 m; 19.11.2009. – MHNG-INVE-69665; Japan, Okinawa Islands, W of Kume Island, 26.3283°N 126.71595°E, 93-101 m; 19.11.2009.

Diagnosis: *Zygophylax* with polysiphonic stem and branches, stem branching several times, hydrocladia alternate. Hydrotheca with long and slender pedicel (part below diaphragm), then widening, opening trumpet-shaped and held perpendicular to the axis of the lower part of hydrotheca (Fig. 10A), resulting in a deep fold on one side, hydrotheca total height 0.5-0.8 mm. Diaphragm well formed. Nematothecae tubular, at base of hydrocladia and on apophyses of hydrothecae, not always present. Gonothecae loosely aggregated in

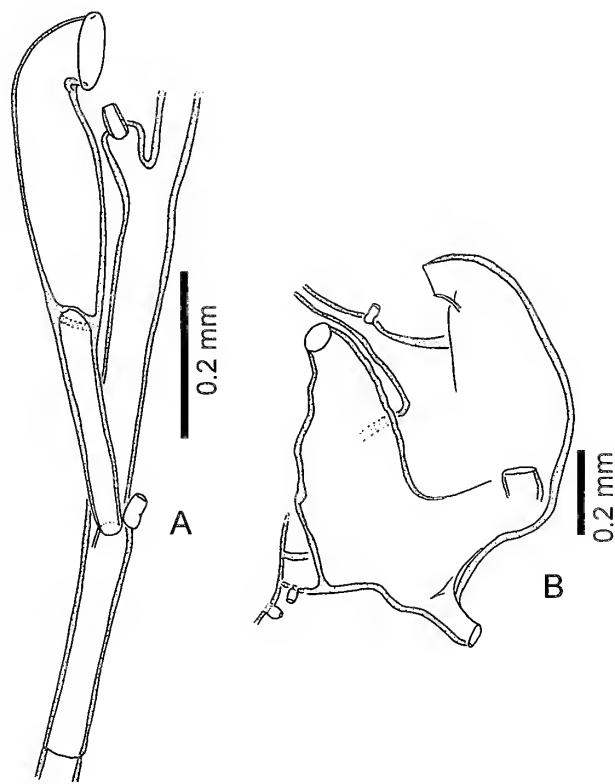


Fig. 10. *Zygophylax sibogae* MHNG-INVE-69633. (A) Part of hydrocladium with one hydrotheca. Note the presence of a small nematotheca on the apophysis. (B) Gonotheca, note irregular shape.

coppinia on stem, gonothecae not adnate, shape very irregular sac-shaped (Fig. 10B), with 1-3 openings on tubular extensions. Coppinia comprise also protective branches, branched, forming canopy over gonothecae, with nematothecae.

Description: See Hirohito (1995), Schuchert (2003), and Vervoort (2006).

Type locality: Indonesia, 5.667°S 132.433°E, 310 m (Rees & Vervoort, 1987).

Distribution: Indonesia, New Zealand, South Africa, Japan, Tasmania, Bay of Biscay to Cape Verde Islands (Vervoort, 2006).

Zygophylax tizardensis Kirkpatrick, 1890

Fig. 11A-B

Zygophylax tizardensis Kirkpatrick, 1890: 12, pl. 3 fig. 3. – Rees & Vervoort, 1987: 66. – Hirohito, 1995: 150, fig. 47a-d, pl. 10 fig. B. – Vervoort & Watson, 2003: 82, fig. 14C-E. – Peña Cantero, Marques & Migotto, 2004: 4, fig. 2C, synonymy.

Acryptolaria normani Nutting, 1927: 209, pl. 41 figs 1-2. – Peña Cantero, Marques & Migotto, 2004: 1, figs 1-2A-B, synonym.

Material: MHNG-INVE-69624; Japan, Okinawa Islands, S of Kume Island, 26.24542°N 126.81745°E, 141-165 m; 20.11.2009; fertile colony. — MHNG-INVE-69660; Japan, Okinawa Islands, NE of S of Kume Island, 26.38277°N 126.799°E, 81-82 m; 10.11.2009; sterile. — MHNG-INVE-69661; Japan, Okinawa Islands, SE of Kume Island, 26.27338°N 126.8581°E, 116 m; 11.11.2009; sterile. — MHNG-INVE-69667; Japan, Okinawa Islands, W of Kume Island, 26.3283°N 126.71595°E, 93-101 m; 19.11.2009; sterile.

Diagnosis: *Zygophylax* with polysiphonic stem and branches, stem not branched or a few times only, hydrocladia alternate. Hydrothecae (Fig. 11A) conical, distal 1/3 to 1/4 bent at right angle, pedicel (part below diaphragm) short, with internal, adcauline semi-circular ridge in about 2/3 of height. Coppinia almost spherical on stem or on branches, composed of relatively few gonothecae and many protective tubes bearing nematothecae (Fig. 11B), branching and anastomosing with each other, covering gonothecae like a canopy. Gonotheca sac-like, at distal end two or three horizontal, curved opening tubes, sometimes with a nematotheca near base (Fig. 11B).

Description: See Hirohito (1995) and Peña Cantero *et al.* (2004).

Type locality: Tizard Reef, Spratly Islands (Chinese Sea) (Kirkpatrick, 1890).

Distribution: Spratly Islands, Japan, Philippines, and New Zealand, 63-720 m.

Family Sertulariidae Lamouroux, 1812

Genus *Caminothujaria* von Campenhausen, 1896

Caminothujaria molukkana von Campenhausen, 1896

Fig. 12

Caminothujaria molukkana von Campenhausen, 1896a: 106. — Vervoort, 1993: 102. — Schuchert, 2003: 182, fig. 38.

Caminothujaria moluccana. — von Campenhausen, 1896b: 306, 314, pl. 15 fig. 8. [incorrect spelling]

Thuiaria divergens Whitelegge, 1899: 372, pl. 23, figs 1-3. — Billard, 1925: 222, synonym.

Sertularia indomalayica Stechow, 1919: 158, new name for *Caminothujaria molukkana* von Campenhausen, 1896.

Sertularella singularis Billard, 1920: 14, fig. 1.

Sertularia sigmagonangia Hargitt, 1924: 495, pl. 5 fig. 20.

Sertularella moluccana. — Billard, 1925: 167, figs 28-29, pl. 7 fig. 19.

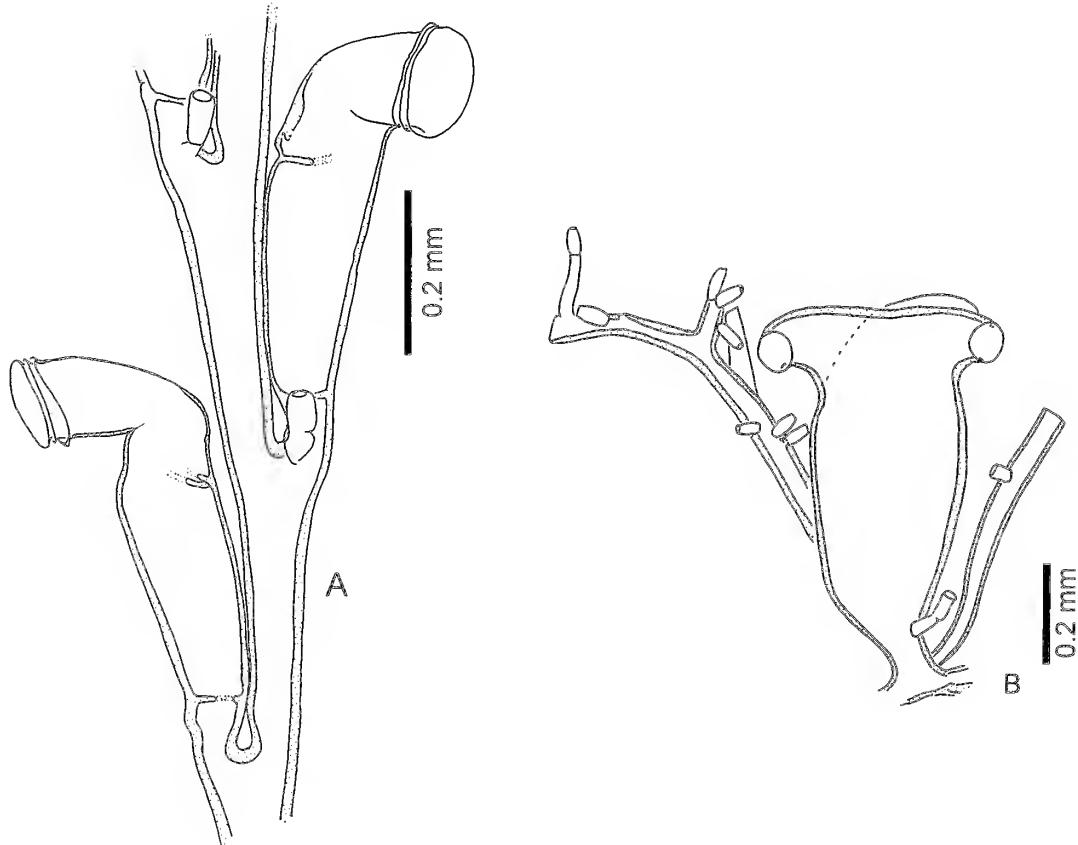


Fig. 11. *Zygophylax tizardensis*, MHNG-INVE-69624. (A) Two hydrothecae of branch, note presence or absence of nematotheca at pedicel base. (B) Gonotheca with protective tubules bearing nematothecae. Note also the single nematotheca at the base of the gonotheca.

Dictyocladium aberrans Nutting, 1927: 214, pl. 41 figs 4-5.
Tridentata funafutiensis Stechow, 1923a: 12, new name for
Thuiaria divergens Whitelegge, 1899.

Material: MHNG-INVE-69636; Japan, Okinawa Islands, S of Kume Island, 26.2601°N 126.8234°E, 91-105 m; 20.11.2009; three plumes with gonothecae.
 - MHNG-INVE-69646; Japan, Okinawa Islands, SE of Kume Island, 26.30028°N 126.82563°E, 30-40 m; 11.11.2009; without gonothecae.

Diagnosis: Sertulariidae with pinnate, polysiphonic stems reaching heights of 7 cm. At least some hydrothecae of the hydrocladia arranged in whorls of four (two opposite pairs, Fig. 12), always also regions with paired hydrothecae or sometimes three hydrothecae per whorl.

Hydrotheca uniform, abcauline wall about 0.45 mm long, diameter of opening 0.22 mm; rim with four low but acute cusps; operculum composed of four valves, pyramid-like; renovations of margin and opercula frequent.

Gonothecae shape elongate fusiform and slightly S-like curved, about 2 mm long, maximal diameter 0.6 mm; with 6-8 transverse crests; opening terminal, surrounded by three distinct cusps, covered by operculum divided into four flaps.

Description: See Hirohito (1995).

Type locality: Ternate, Moluccas, Indonesia (von Campenhausen, 1896a).

Distribution: Indonesia, Funati Atoll, Philippines, Macclesfield Bank (Chinese Sea), Japan.

Remarks: This is the first record of this characteristic tropical species for Japan, which was otherwise only known to occur from Indonesia to the Philippines. It

was noted that 2-3 finger-like processes arise from the bottoms of the hydrothecae (Fig. 12). These processes were also observed in material from the Kei Islands (Schuchert, 2003).

Genus *Sertularella* Gray, 1848

Sertularella mirabilis Jäderholm, 1896

Fig. 13

Sertularella mirabilis Jäderholm, 1896: 9, pl. 2 fig. 1. – Nutting, 1927: 216, pl. 42 figs 3-4. – Hirohito, 1995: 195, fig. 64a-g, pl. 12 fig. B. – Park, 2010: 96, fig. 53.

Material: MHNG-INVE-69650; Japan, Okinawa Islands, SE of Kume Island, 26.2624°N 126.857°E, 150-168 m; 12.11.2009, without gonothecae.

Diagnosis: *Sertularella* species with colony developing into a three-dimensional lattice, resembling a sponge, size up to 10 cm. Hydrothecae typical for genus, usually with several transverse ridges, somewhat variable. Gonotheca ovoid, opening on terminal neck, main body usually with transverse sculptures.

Description: See Hirohito (1995).

Type locality: Japan, off Hirado, 33.167°N 129.300°E, 82 m depth (Jäderholm, 1896).

Distribution: South China Sea, Japan, Korea.

Remarks: The unique, three-dimensional structure resembling a sponge (Fig. 13A) makes this species rather easy to identify.

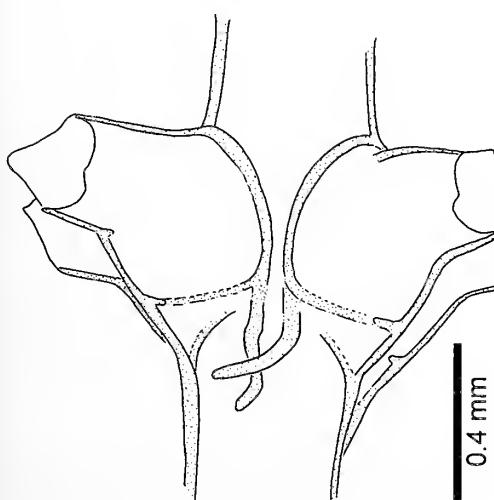


Fig. 12. *Caminothujaria molukkana*, MHNG-INVE-69636, whorl of four hydrothecae from hydrocladum.

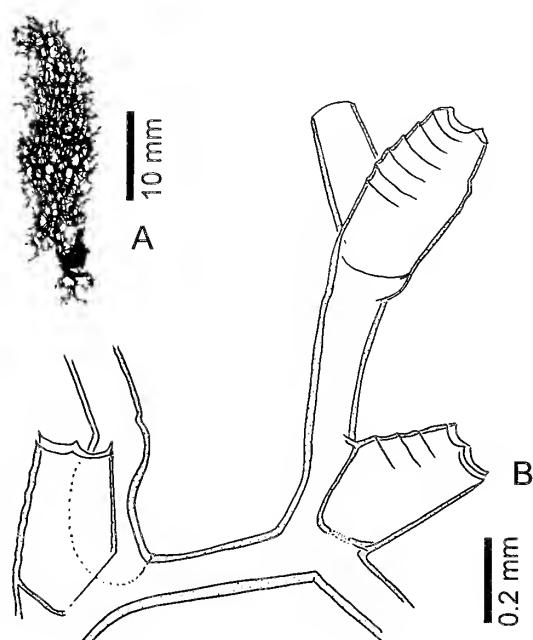


Fig. 13. *Sertularella mirabilis*, MHNG-INVE-69650.
 (A) Colony silhouette. (B) Hydrothecae.

Family Thyroscyphidae Stechow, 1920

Genus *Thyroscyphus* Allman, 1877

***Thyroscyphus fruticosus* (Esper, 1797)**

Fig. 14

Sertularia fruticosa Esper, 1797: plate 34.

Sertularia laxa Lamarck, 1816: 116. (new name for Esper's material)

Laomedea fruticosa. – Hammer in Esper, 1829: 162.

Thyroscyphus vitiensis Marktanner-Turneretscher, 1890: 210, pl. 3 fig. 4. – Gibbons & Ryland, 1989: 427, synonym.

? *Campanularia thyroscyphiformis* Marktanner-Turneretscher, 1890: 206, pl. 3 fig. 4. – Rees & Vervoort, 1987: 67.

Campanularia juncea Allman, 1876: 260, pl. 11 fig. 3-4.

Thyroscyphus fruticosus. – Splettstösser, 1929: 7, figs 1-11, 13-27. – Ralph, 1961: 754, fig. 1a. – Vervoort, 1967: 35, figs 8-9. – Millard, 1975: 323, fig. 104. – Gibbons & Ryland, 1989: 425, fig. 40. – Watson, 2000: 38, fig. 29D. – Schuchert, 2003: 195, fig. 49.

Material: MHNG-INVE-91095; Japan, Okinawa Island, off Ada village, depth 7 m; 21.06.2008; two fertile colonies.

Diagnosis: Indo-Pacific *Thyroscyphus* with erect, flat, pinnately branched colonies, rose-pink in life, 5-20 cm, stem stiff, monosiphonic, nodes absent or indistinct. Hydrocladia alternate, nodes indistinct or absent. Hydrotheca campanulate, wall smooth, 1-1.2 mm deep, diameter at opening 0.5-0.6 mm, slightly bilateral symmetric through bulging upper side and almost straight underside, at base a distinct diaphragm, margin mostly smooth, occasionally with four indistinct, shallow cusps. Operculum four triangular flaps, usually lost and only present in very young hydrothecae. Gonothecae on stem and hydrocladia, developing on apophyses of hydrothecae, about 2 mm long, oblong oval, basal part tapering, end truncated, wall smooth.

Description: See Schuchert (2003).

Type locality: Indian Ocean (Esper, 1829).

Distribution: Tropical Indo-West Pacific, Japan, New Zealand, southern and western Africa, Mediterranean (Schuchert, 2003).

Remarks: This species was named by Esper (1788-1830) in a work which appeared in numerous issues, the text and plates usually at very different dates. His figures, labelled *Sertularia fruticosa*, permit to recognise the species unambiguously. The publication date of this plate has only become known through the investigations of Grasshoff & Scheer (1991). According to the latter publication, the plate 34 with *S. fruticosa* was published in 1797. Lamarck (1816) named Esper's hydroid *Sertularia laxa*, which must now be taken as an objective synonym. The text for Esper's plate was only published 19 years after Esper's death in 1829 by H. L. Hammer under the name *Laomedea fruticosa* [note, the genus *Laomedea* was introduced by Lamouroux (1812), so it was not known to Esper].

Thyroscyphus fruticosus is a common and widespread hydroid in the tropical Indian- and western Pacific Ocean. Its occurrence in Japanese waters is here documented for the first time.

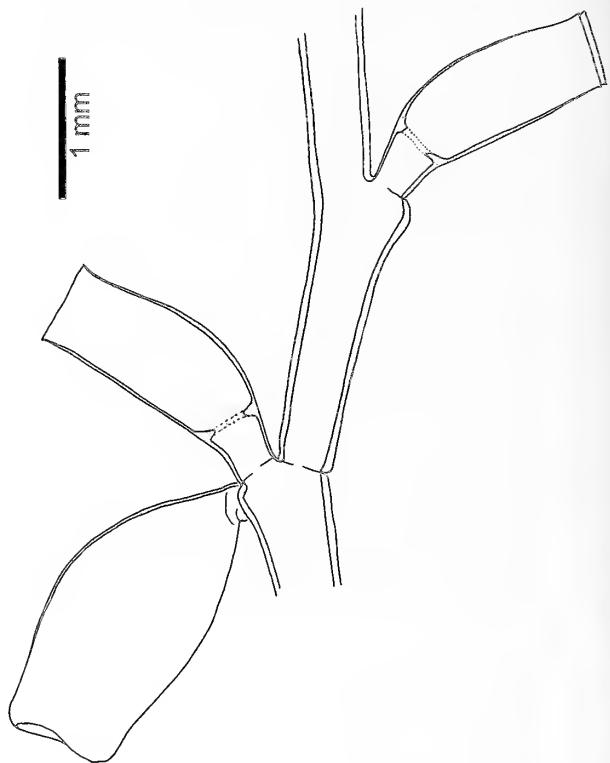


Fig. 14. *Thysroscyphus fruticosus* MHNG-INVE-91095, part of hydrocladium with two hydrothecae and a gonotheca (lower left).

Family Haleciidae Hincks, 1868

Genus *Hydrodendron* Hincks, 1874

***Hydrodendron stechowi* Hirohito, 1995**

Fig. 15

Ophioides arboreus. – Stechow, 1913: 87. – Jäderholm, 1919: 6, pl. 1 fig. 6. [not *Hydrodendron arboreum* (Allman, 1888)]

Hydrodendron (Dendrophiodissa) stechowi Hirohito, 1995: 32, fig. 9a-c, pl. 2 fig. 2.

Material: MHNG-INVE-69647; Japan, Okinawa Islands, SE of Kume Island, 26.2624°N 126.857°E, 150-168 m; 12.11.2009; 1 colony 7 cm without gonothecae.

Diagnosis: Colonies up to 18 cm high, stem polysiphonic and branching, Hydrocladia monosiphonic, pinnately arranged in two rows, opposite or subopposite. Hydrocladia subdivided by transverse nodes delimiting segments of variable length. Each segment with a hydrotheca near its distal end, alternating

sides and thus in two rows. Hydrotheca on short hydrophore, adcauline side of hydrophore very short or non-existent, hydrotheca thus sessile. Hydrotheca 0.2 mm in diameter and very short (about 20 µm high), inclined about 45° towards below, walls straight, on inside a number of thick desmocytes. On about every second to third segment a nematotheca, located close to proximal end of segment on side opposite of hydrotheca. Nematothecae similar to hydrotheca but smaller (about 1/3), a short, somewhat conical collar surrounding a hole in the segment. On inside of nematotheca a number of thick desmocytes. Gonotheeae loosely aggregated in a scapus attached to the stem. Scapus consist of tangled mass of tubes bearing paired gonothecae. Gonothecae flask-shaped, opening in a distal neck which is not recurved (after Hirohito, 1995).

Description: See Hirohito (1995).

Type locality: Japan, Honshu Island, Sagami Bay, Okinose Bank (Hirohito, 1995).

Distribution: Japan only; Sagami Bay (Steehow, 1913; Hirohito, 1995), Goto Islands (Jäderholm, 1919), Okinawa Islands (this study). Depth range from 30 to 200 m.

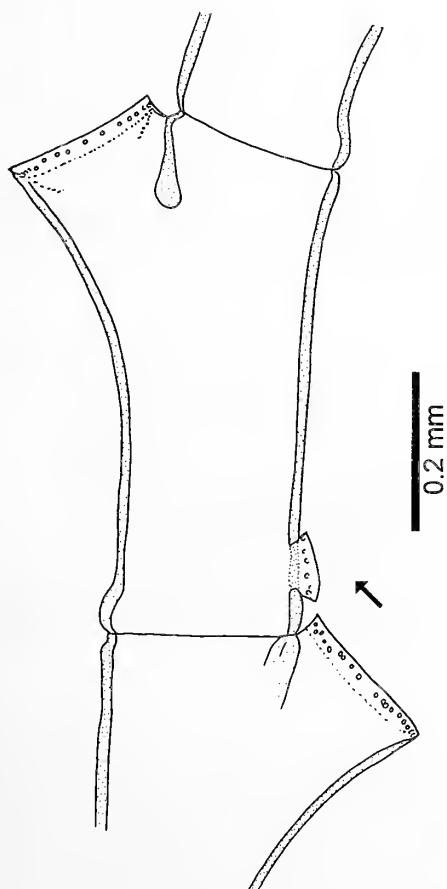


Fig. 15. *Hydromedron stechowi*, MHNG-INVE-69647, hydrocladial segment with a nematotheca near its base (arrow).

Remarks: This species resembles *H. arboreum* (Allman, 1888) and *H. tottoni* Rees & Vervoort, 1987. These two species have gonothecae with recurved necks. Moreover, the nematothecae are smaller and the position appears to move towards the middle of the segment (see Ralph, 1958; Peña Cantero & Ramil, 2006).

Hydromedron leloupi Hirohito, 1983

Fig. 16A-B

Diplocyathus dichotomus. – Leloup, 1938: 5, fig. 2. [not *Diplocyathus dichotomus* Allman, 1888]

Hydromedron leloupi Hirohito, 1983: 13, fig. 2.

Hydromedron (Hydromedron) leloupi. – Hirohito, 1995: 34, fig. 9d-j, pl. 2 fig. D.

? *Phylactotheca pacifica* Stechow, 1913: 155, fig. 135.

Material: MHNG-INVE-69631; Japan, Okinawa Islands, N of Kume Island, 26.39317°N 126.7535°E, 95.5-123 m; 19.11.2009; several stems, up to 5 cm, one with 2 presumed gonothecae. – MHNG-INVE-69651; Japan, Okinawa Islands, SE of Kume Island, 26.2624°N 126.857°E, 150-168 m; 12.11.2009; 7 cm stem, no gonothecae, few nematothecae.

Diagnosis: Colonies 3-10 cm, mono- or polysiphonic stem, branched or not, hydroeladia more or less pinnately arranged, monosiphonic, with oblique or transverse nodes, nodes irregular and internodes of different length and with differing numbers of hydrothecae. Hydrothecae in two rows, alternating sides, on short apophyses of hydrocladia, about 0.3 mm long, deep, trumpet-shaped, margin smooth and slightly everted. On inside of hydrotheca an irregular circle of refringent dots, diaphragm extremely thin and inconspicuous (often invisible), oblique. Nematothecae goblet-shaped, about 70 µm, placed mostly immediately distal to apophyses, but also on apophyses possible, not all apophyses have nematothecae, sometimes they can be rare. Gonothecae up to 0.9 mm high and half as wide, on basal part of stem or stolons, not aggregated, conical when young, mature cylindrical. Larviparous.

Description: See Hirohito (1983, 1995).

Type locality: Japan, Bonin Islands (Hirohito, 1983).

Distribution: Japan.

Remarks: The stem heights in Hirohito (1983, 1995) are given incorrectly in mm instead of cm.

This species is very unlike *Halecium* and rather reminiscent of *Zygophylax* (Lafoeidae). Molecular data are needed to corroborate the correct genus allocation.

In the present material, only one stem had two structures that could be gonotheeae (Fig. 16B). They were conical, with some transverse creases. They are thus unlike the smooth, cylindrical gonothecae depicted in Hirohito (1995). Because these thecae were empty, only about half

the size as given by Hirohito, and partially damaged, they are perhaps only aborted growth-stages of basal parts of normal gonothecae.

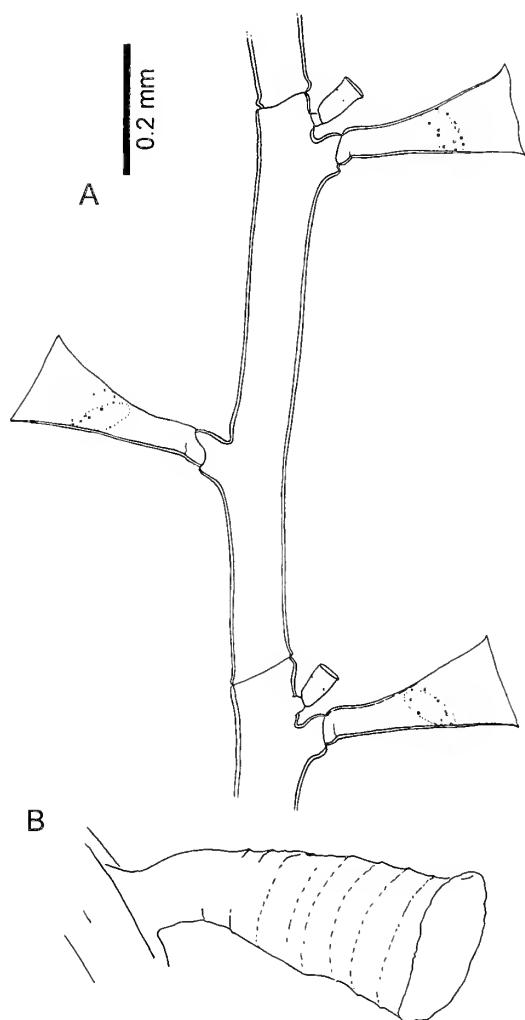


Fig. 16. *Hydrodendron leloupi*, MHNG-INVE-69651. (A) Part of hydrocladium. Note the two nematothecae distal to the apophyses. (B) Presumed gonotheca or part of a gonotheca; same scale as A.

Family Halopterididae Millard, 1962
Genus *Antennella* Allman, 1877

***Antennella quadriaurita* Ritchie, 1909**
Fig. 17A-C

Antenella quadriaurita Ritchie, 1909: 92, fig. 9. – Millard, 1977: 123, fig. 8. – Schuchert, 1997: 29, fig. 9. – Vervoort & Watson, 2003: 344, fig. 83F-I. – Galea, 2010: 11, fig. 4s.

Antenella quadriaurita forma africana Broch, 1914: 26.

Antennella africana. – Ralph, 1961: 23, figs 1a-c, f-g. – Millard, 1975: 331, fig. 107A-E.

Antennella serrata Totton, 1930: 212, fig. 53. – Ralph, 1961: 25.

Antennella paucinoda Fraser, 1935: 110, pl. 2 fig. 10. – Hirohito, 1995: 235, fig. 78d-g.
Antennella variabilis Fraser, 1936: 52, fig. 6a-c.

Material: MHNG-INVE-69641; Japan, Okinawa Islands, SE of Kume Island, 26.2836°N 126.90072°E, 142-149 m; 13.11.2009; with gonothecae. – MHNG-INVE-69657; Japan, Okinawa Islands, W of Kume Island, 26.3474°N 126.6886°E, 96-186 m; 19.11.2009; with gonothecae; hydrotheca diameter 0.25-0.26 mm, abcauline wall 0.25-0.29 mm, stem diameter 0.12-0.14 mm, stem height up to 38 mm.

Diagnosis: *Antennella* species, stems up to 4 cm, with two pairs of lateral nematothecae (2 x 2), the more adcauline pair usually slightly smaller. One median inferior nematotheca well below hydrotheca. Intersegments with no hydrotheca delimited by distal

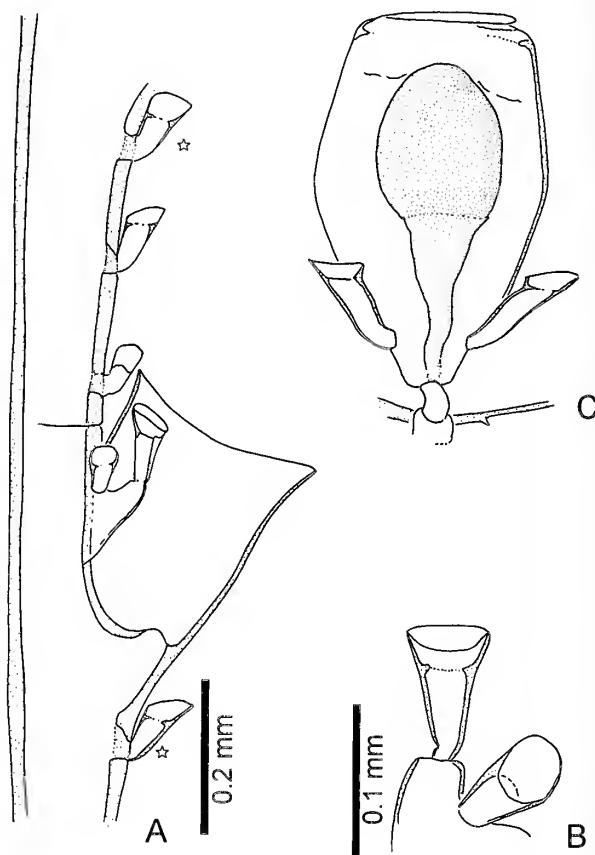


Fig. 17. *Antennella quadriaurita*, MHNG-INVE-69657. (A) Lateral view of stem with a hydrotheca. As typical for the samples examined here, the oblique nodes below the median inferior nematothecae are not visible. The transverse nodes above the hydrothecae are distinct, but weak too. Two homologues of median inferior nematothecae are marked with stars. (B) Pair of lateral nematothecae seen from adcauline side. (C) Gonotheca with soft tissue indicated, interpreted as female, same scale as A. The axis of the stem is horizontal in this figure.

oblique and proximal transverse node. Intersegments with 1-4 median nematothecae. Either the transverse or the oblique nodes can be weak or absent. Hydrotheea cylindrical, margin may be somewhat everted, adcauline side free for about 1/2 of length. Gonothecae of both sexes on same stem or not. Female gonothecae larger, two nematothecae at base, obtuse distal end with flat lid; male smaller, one nematotheca near base.

Description: See Schuchert (1997).

Type locality: Gough Island, South Atlantic; 183 m (Ritchie, 1909).

Distribution: Bermuda; Cuba; Tristan da Cunha Islands group; tropicel west Africa; Vema Seamount; South Africa; India; New Zealand, Japan; Korea (Schuchert, 1997; Vervoort & Watson, 2003; Galea, 2010).

Remarks: The present material matched other material of this species described in Schuchert (1997), except for the oblique nodes which were mostly weak or entirely reduced. Some few, deep oblique nodes were, however, always present in an individual stem. This morphotype with reduced oblique nodes is so far only known from Japan and it has been described as a distinct species *Antennella paucinoda* Fraser, 1935. Hirohito (1995) redescribed *A. paucinoda*, but acknowledges its close similarity to *A. quadriaurita*. The latter is currently seen as a rather variable species (Schuchert, 1997) and within its broad scope, solely the reduction of the oblique nodes cannot be considered as sufficient to maintain *A. paucinoda* as a separate species. Because it has pairs of lateral nematothecae and no median one behind the hydrotheea it cannot be regarded as conspecific with *A. secundaria* as thought by Leloup (1938) and later uncritically reiterated by Schuchert (1997).

Family Schizotrichidae Peña Cantero, Sentandreu & Latorre, 2010
Genus *Schizotricha* Allman, 1883

Schizotricha longinema new. spec.

Fig. 18A-G

Holotype: MHNG-INVE-69653; Japan, Okinawa Islands, SE of Kume Island, 26.2776°N 126.89145°E, 151-160 m; 12.11.2009; without gonothecae, one plume, slide and alcohol material, hydrocladia unbranched.

Paratypes: MHNG-INVE-89083; Japan, Okinawa Islands, SE of Kume Island, 26.2776°N 126.89145°E, 151-160 m; 12.11.2009; one plume in aleohol, branched hydrocladia. – MHNG-INVE-89084; Japan, Okinawa Islands, SE of Kume Island, 26.2624°N 126.857°E, 150-168 m; 12.11.2009; in alcohol, one plume with gonotheeae, with branched hydrocladia.

Diagnosis: *Schizotricha* species with polysiphonic stem,

up to 5 cm; the nematotheca immediately proximal of the hydrocladial hydrothecae (median inferior) exceptionally long, reaching 0.5 mm in size, movable. Other nematothecae large, but sizes fall within usual range. Gonothecae small, arising just proximal of long nematothecae, without nematothecae. Adcauline wall of hydrotheea completely adnate, hydrothecae rather shallow, as wide as deep, walls may be thickened.

Etymology: The specific epithet is derived from “long” and “nematotheca”.

Type locality: Japan, Okinawa Islands, SE of Kume Island, 26.2776°N 126.89145°E, 151-160 m.

Description: Pinnate colonies, up to 5 cm, arising from hydrorhiza formed by a tangled mass of stolons. Stem straight, unbranched, polysiphonic except for distal end, composed of a bundle of auxiliary tubed and a central main tube. Auxiliary tubes unsegmented, with movable nematothecae. Main tube with occasional transverse nodes only, with alternately arranged, long apophyses on which the hydrocladia are attached (Fig. 18C). In the upper axil of each apophysis a hydrotheca (Fig. 18B), slightly more shallow than the hydrocladial ones. Associated with each cauline hydrotheca are two lateral nematothecae, these much larger than hydrotheca, movable, the one on the side of the apophysis somewhat displaced behind the hydrotheca and directed away from it, hence often difficult to see. One more nematotheca on apophysis, at least one more nematotheca below apophysis on opposite side of the latter.

Hydrocladia thin and flexible, branched or not, if branched then bifurcation at level of first hydrotheca, total length up to 12 mm with up to 17 hydrothecae. First segment of hydroeladium short, without nematotheca. Rest of hydrocladium with irregularly occurring transverse nodes so that there are 1-3 hydrothecae per internode. No internal ribs. Hydrotheca rather shallow, about as wide as deep, cylindreal or cup-shaped, adcauline wall completely adnate, opening perpendicular to hydrocladium axis. Some hydrothecae may have very thick walls (Fig. 18F). Associated with each hydrotheca are the three usual nematothecae, a pair of laterals and a median inferior nematothecae. The median inferior nematotheca extraordinarily long (0.5 mm), usually straight, movable, two chambered, upper chamber large. All median inferior nematothecae of hydrocladium are of this length. The two lateral nematothecae as all others conical, movable, two-chambered, in comparison to hydrotheca relatively large, adcauline side slightly lowered. In addition to these three nematothecae about three median nematothecae between each pair of hydrothecae (Fig. 18D).

Gonothecae develop on hydrocladium immediately proximal of long median inferior nematothecae, up to 0.2 mm long, pear-shaped, without nematothecae.

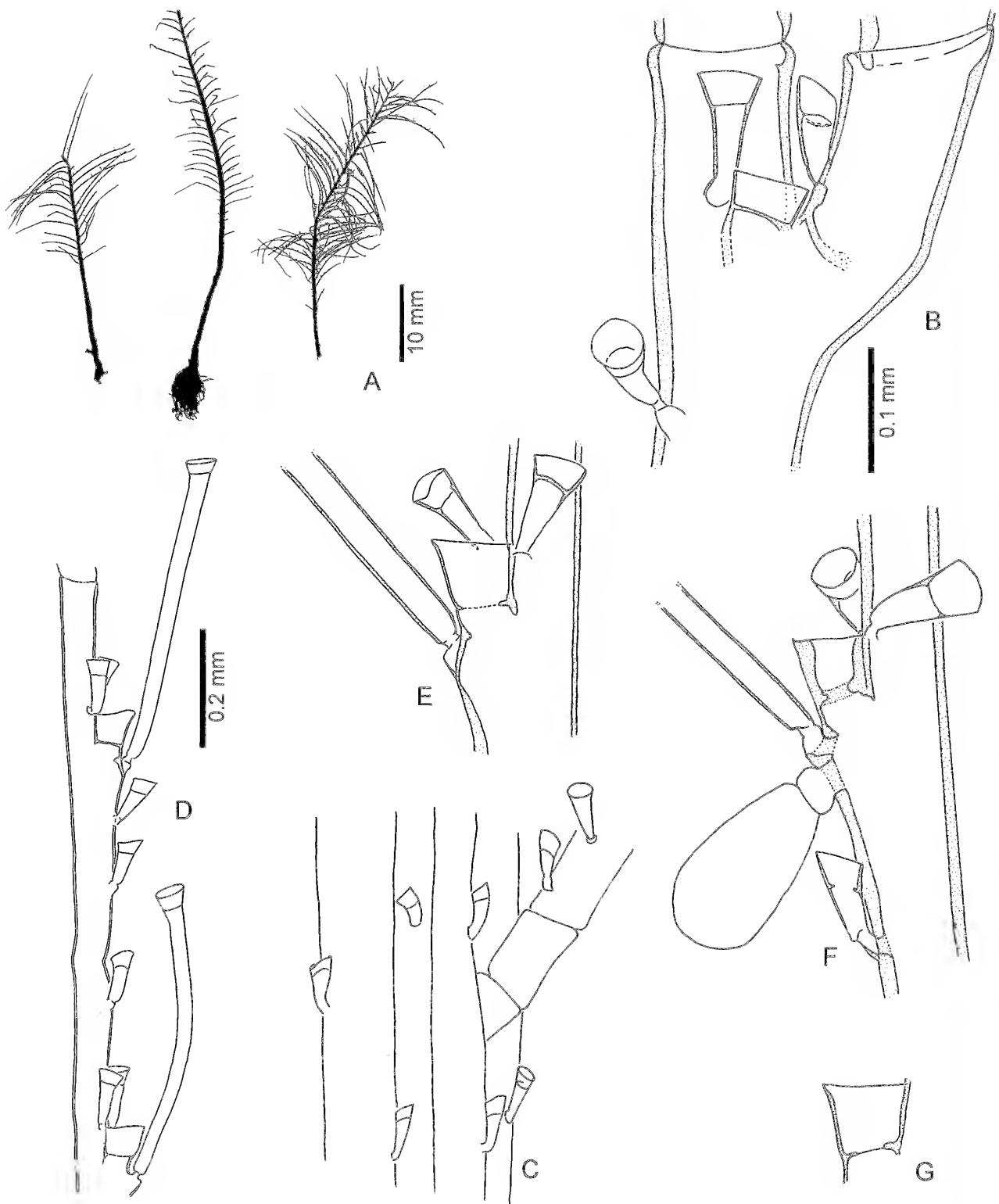


Fig. 18. *Schiztricha longinema* new. spec., B-E holotype, F-G paratype. (A) Colony silhouettes, from left: holotype, paratype MHNG-INVE-89083, paratype MHNG-INVE-89084. (B) Main tube of stem in monosiphonic part showing at right an apophysis and a hydrotheca in its axil. Note that the right lateral nematothecae associated with the hydrotheca is not shown. It is usually displaced somewhat to the rear of the hydrotheca and difficult to observe. The nematotheca on the apophysis is an additional one, not the lateral one. (C) Stem in basal, polysiphonic part, showing auxiliary tubes bearing nematothecae and the base of a hydrocladium coming from the hidden main tube (same scale as D). (D) Part of hydrocladium with two hydrothecae. Note the characteristic, extremely long median inferior nematothecae. (E) Hydrotheca and its associated nematothecae, median inferior nematotheca only shown partially. Same scale as B. (F) Like E, but with gonotheca. Note the thickened hydrothecal wall. Same scale as B. (G) Hydrotheca of same branch as F but more distal, the hydrothecal wall is not thickened. Same scale as B.

Dimensions:

Plume heights: 3.5-5 cm
 Main tube diameter: 0.11 mm
 Apophyses: 0.2 mm
 Hydrotheca of branches, abcauline wall: 50-55 µm
 Hydrotheca diameter: 50-60 µm
 Hydrocladium diameter: 40-105 µm
 Median inferior nematotheca length: 0.5-0.56 mm
 Lateral nematothecae on branches: 80-95 µm

Distribution: Okinawa Islands.

Remarks: All species of the genus *Schizotricha* have been reviewed by Peña Cantero & Vervoort (1999). Based on 16S gene sequence data, Peña Cantero *et al.* (2010) separated the genus from the Halopterididae and placed it in its own family Schizotrichidae.

The new species described here is unique among its congeners and immediately recognisable due to its very long median inferior nematothecae (Fig. 18D), which are about ten times the size of the hydrotheca. They are of a very exceptional length and no comparable case within the Plumularioidea is known. If not lost due to the collecting process, all median inferior nematothecae were of this size, this in all three specimens from two different localities. The length is thus not just a developmental aberration. Somewhat unusual for the genus, the gonothecae lacked nematothecae. Perhaps this is related to the hypertrophied adjacent median inferior nematotheca. It was not possible to identify reliably the sex of the gonothecae in the present sample, but they were more likely female.

126.8162°E, 123-153 m; 20.11.2009; sterile colony. – MHNG-INVE-69620; Japan, Okinawa Islands, S of Kume Island, 26.2545°N 126.7946°E, 114-115 m; 13.11.2009; sterile colony. – MHNG-INVE-69637; Japan, Okinawa Islands, S of Kume Island, 26.2601°N 126.8234°E, 91-105 m; 20.11.2009; sterile colony. – MHNG-INVE-89122; Japan, Okinawa Islands, SE of Kume Island, 26.2624°N 126.857°E, 150-168 m; 12.11.2009; colony with gonothecae.

Diagnosis: Colonies 4-13 cm high, stems unbranched, bases bundled and overgrown with stolon-like tubes thus giving polysiphonic appearance. Hydrocladia arranged in whorls, 2 to 5 hydrocladia per whorl, most frequently 2-4, adjacent whorls decussate, resulting in hydrocladia issuing in all directions from stem. Apophyses with 1-3 nematothecae. First segment of hydrocladium always lacking a hydrotheca, with one nematotheca in proximal region, rest of stem heteromerously segmented with main- and intersegments, nodes distinct. Main segments with hydrotheca in middle and the typical three nematothecae, median one not reaching to level of hydrotheca. Abaxial side of hydrotheca completely adnate. Intersegments elongate, shorter or as long as main segments, with 1 to 2 nematothecae, usually either 1 or 2 in the whole colony and not so much variable within a colony. Gonothecae in axils of apophyses of stem, pear shaped, opening terminal, at right angle to long axis.

Description (Okinawa material): Colonies 4-8 cm high when mature, arising from a tuft of root-like, tubular stolons. Base of colony about 1-2 cm, composed of several stems and overgrown with stolon-like tubules, appearing thus tree-like with polysiphonic trunk (Fig. 19A). Stems above trunk-region free, irregular, unbranched, monosiphonic, with canaliculate coenosare, perisarc nodes sparse. Hydrocladia arranged in whorls, predominantly one opposite pair per whorl (Fig. 19B), adjacent whorls decussate, resulting in hydrocladia issuing in all directions from stem. This pairwise arrangement occasionally in some parts replaced by 3-4 hydrocladia per whorl, or hydrocladia singly and irregularly arranged. Younger stems may have a true pinnate arrangement of hydrocladia as they are in two lateral rows only (not decussate).

Hydrocladia arise on long apophyses of stem, hydrocladia thin and relatively short (5 mm). Apophyses with 1-3 nematothecae in upper axil. Hydrocladia with distinct, first segment without hydrotheca and one nematotheca (if not lost), this segment always present. Remainder of hydrocladium heteromerously segmented by tandem repeats of main- and intersegments (Fig. 19C), 4-7 repeats per hydrocladium. Main segment with hydrotheca in lower third, almost entirely adnate, walls straight, not much thickened, opening tilted. One median inferior nematotheca and a pair of lateral nematothecae.

Family Plumulariidae Agassiz, 1862 Genus *Nemertesia* Lamouroux, 1812

Nemertesia octoseriata (Jäderholm, 1896) Fig. 19A-E

Antennularia octoseriata Jäderholm, 1896: 15, pl. 2 fig. 6.
Antennularia dendritica Stechow, 1908: 195.
Antennularia Perrieri. – Stechow, 1909: 81. [not *Nemertesia perrieri* (Billard, 1901)]
Nemertesia irregularis. – Jäderholm, 1919: 23 pl. 5 fig. 7. [not *Antennularia irregularis* Quelch, 1885 = *Nemertesia antennina* (Linnaeus, 1758)]
Nemertesia antennina. – Hirohito, 1983: 66, fig. 34a-b. – Hirohito, 1995: 264, fig. 89a-g. – Park, 2010: 140, fig. 78A-E. [not *Nemertesia antennina* (Linnaeus, 1758)]

Type material: UUZM specimen number UPSZ-TY2136; holotype of *Nemertesia octoseriata* Jäderholm, 1896; Japan, Hirado Strait, 33°5'–33°15'N 129°15'–129°16'E, 44 fathom (80 m); one sterile colony in alcohol. – ZSM 20051190, 20051186, and 20051194; 3 slides made by Stechow from holotype of *Antennularia dendritica* Stechow, 1908, Japan, Sagami Bay.

Non-type material: MHNG-INVE-69619; Japan, Okinawa Islands, S of Kume Island, 26.2466°N

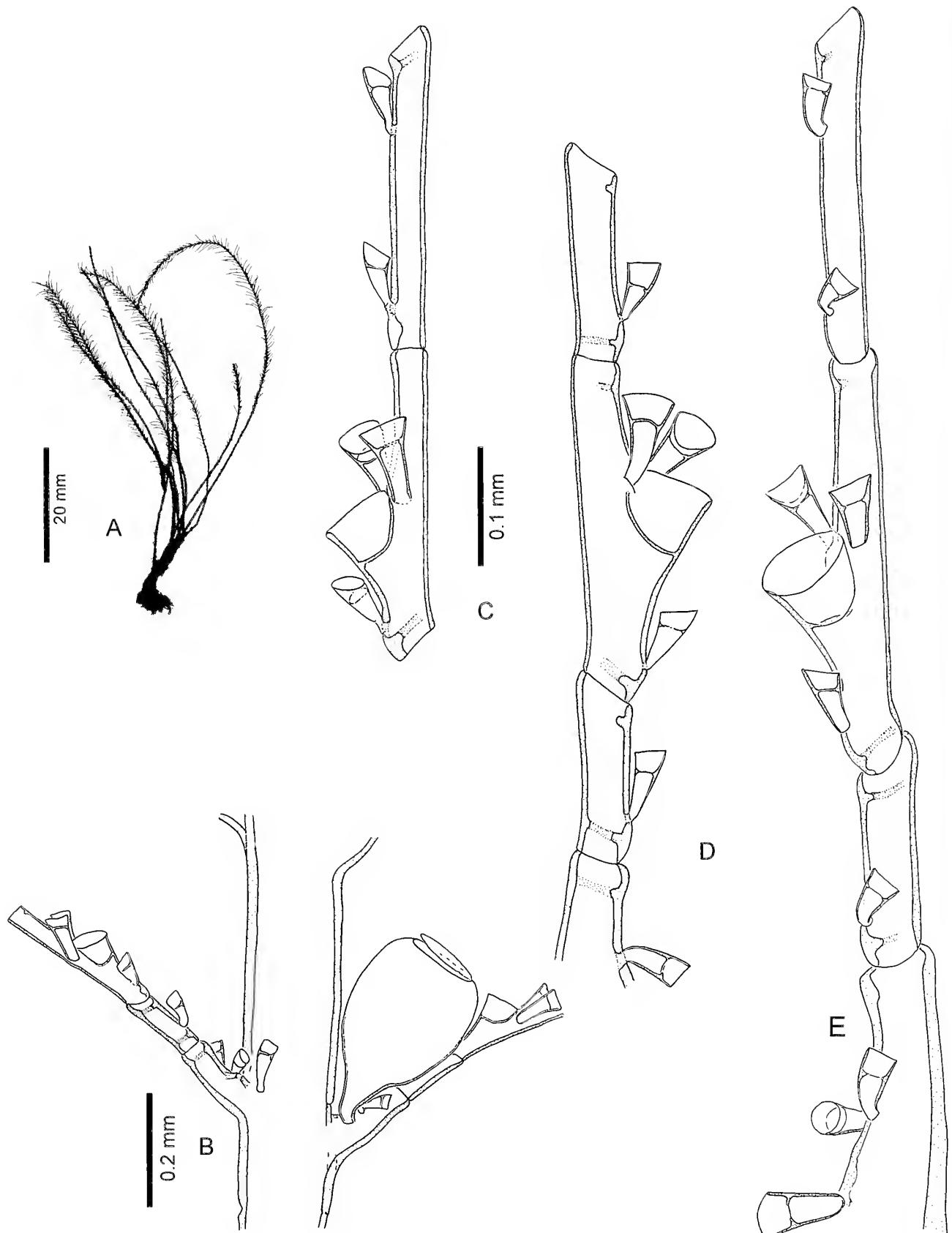


Fig. 19. *Nemertesia octoseriata*. (A) Colony silhouette, MHNG-INVE-69639. (B) Part of stem with hydrocladia and a gonotheca on an apophysis, MHNG-INVE-89122. (C) Main- and intersegment of hydrocladium, MHNG-INVE-89122. (D) Apophysis, first segment, main- and intersegment of hydrocladium, holotype of *Nemertesia octoseriata*, same scale as C. (E) Apophysis, first segment, main- and intersegment of hydrocladium, holotype of *Nemertesia dendritica* (Stechow, 1908), same scale as C.

Nematothecae longer than hydrotheca, conical, movable, adcauline wall of upper chamber depressed. Intersegments long, usually with two median nematothecae (if not lost). Gonothecae arise on apophyses of stems (Fig. 19B), pear-shaped, 0.3-0.35 mm long, opening terminal and perpendicular to long axis, with round operculum.

Dimensions: MHNG-INVE-69620

Distance between hydrocladial whorls: 0.3-0.48 mm
 Diameter of stem: 0.16-0.18 mm
 Length main segments: 0.19-0.31 mm
 Diameter main segment: 0.30-0.40 mm
 Length intersegments: 0.21-0.27 mm
 Diameter hydrotheca: 60-70 µm
 Depth hydrotheca: 40-50 µm
 Lateral nematotheca length: 60-70 µm

Type locality: Japan, Kyushu, Hirado Strait, 33°5' - 33°15'N 129°16'-129°15'E, 80 m deep (Jäderholm, 1896).

Distribution: Japan (Sagami Bay to Nagasaki, Okinawa Islands), Korea.

Remarks: The identity and scope of this species and the material from Okinawa was quite difficult to establish. It was necessary to examine the type material of *Nemertesia octoseriata* (Jäderholm, 1896) and *N. dendritica* (Stechow, 1908).

The first Japanese *Nemertesia* species was described by Jäderholm (1896), based on material from near Nagasaki (Hirado Strait, as *Antennularia octoseriata*). Later (1926), Jäderholm synonymised this name with *N. irregularis* (Quelch, 1885), a nominal species based on material from the Cape Verde Islands and nowadays regarded as a synonym of *N. antennina* (Linnaeus, 1758) (Ansín Agís *et al.*, 2001). Jäderholm's material has four hydrocladia per whorl, resulting in eight longitudinal rows of hydrocladia due to the decussate arrangement. The intersegments have one nematotheca only (Fig. 19D). Stechow (1908) then described a new Japanese species *Nemertesia dendritica* with two to three hydrocladia per whorl and two nematothecae per intersegment (Fig. 19E). Shortly afterwards, Stechow (1909) concluded that his *N. dendritica* was identical to *N. perrieri* (Billard, 1901) from the Canary Island, mainly due to the presence of two nematothecae per intersegment. *Nemertesia perrieri* is nowadays regarded as a valid species (Ansín Agís *et al.*, 2001), although some authors think it could be a synonym of *N. antennina*. Molecular results indicate that the situation may be much more complex (Moura *et al.*, 2012).

Hirohito (1995) treated both Jäderholm's and Stechow's species as a synonym of *N. antennina*. Likewise, Park (2010) documented material which is clearly identical to the Okinawa material of this study referring it to *N. antennina*.

During the recent years I have examined dozens of living *N. antennina* colonies from the NE Atlantic and I think

they are distinct from the Japanese ones. However, the only solid diagnostic trait is found in the gonotheca. In Atlantic *N. antennina* and *N. perrieri*, the opening of the gonotheca is always sublateral and inclined sideways (comp. Ansín Agís *et al.*, 2001). In the Japanese material it is terminal and at a right angle to the long axis (Fig. 19B). Other differences are the constant presence of a first ahydrothecate node (Fig. 19B, variable in *N. antennina*), the more delicate stems (about half the diameter), the smaller size, and a more pronounced bundling of the stem bases and a more profuse overgrowth by stolons (well documented by Hirohito, 1995: fig. 89a-b).

Due to these differences – and also the wide separation of the Japanese and European populations – *Nemertesia octoseriata* should therefore be regarded as distinct from *N. antennina* until molecular studies prove the contrary. The molecular studies of Moura *et al.* (2012) on NE Atlantic *Nemertesia* in fact indicate that *N. antennina* is potentially a species complex. This can be used as an argument not to synonymise too readily species with disjunct distributions as it is the case for Japanese and European *Nemertesia*.

Nemertesia octoseriata is paralleling *N. antennina* in its variability and it is not entirely clear if *N. dendritica* is not a distinct species. *Nemertesia dendritica* has 2-3 hydrocladia per whorl, while the type specimen of *N. octoseriata* has four per whorl. Moreover, the former has two nematothecae per intersegment (Fig. 19E), while the latter has one only (Fig. 19D). Both characters usually correlate, meaning colonies with two hydrocladia per whorl have two nematothecae per intersegment (Fig. 19C-B, *dendritica* form), while those with four hydrocladia per whorl have usually one nematotheca per intersegment (*octoseriata* form). Such a correlation of two putatively independent characters is often suggestive for two distinct species being present. However, in the present case it could also be due to environmental factors and more importantly to the age of the stem. Young stems are pinnate and then develop tetraserial hydrocladia. Octoserial stems are likely found in fully grown, old stems only.

Although the material from Okinawa represented the *dendritica* form, some stems had 4-5 hydrocladia per whorl (but still two nematothecae per intersegment). The material from Korea described by Park (2010) appears identical to the Okinawa material. The abundant material examined and described by Hirohito (1995) was evidently very variable and comprised both forms. He depicts the *octoseriata* form (fig. 2), but in one hydrocladium (fig. 2e) there are two nematothecae per intersegment. At present it seems thus reasonable to regard *N. dendritica* as a synonym of *N. octoseriata*, a rather variable species which mirrors the situation in the Atlantic for *N. antennina*, *N. perrieri* and *N. irregularis*.

Nemertesia spec. 1

Fig. 20A-D

Material: MHNG-INVE-91092; Japan, Okinawa Island, Motobu Peninsula, 26.71372°N 127.8786°E, depth 29 m; 19.06.2008; two complete and two partial stems, all sterile.

Diagnosis: Weakly polysiphonic at stem base, 8 cm, a few stems clustered, distal part bearing hydrocladia monosiphonic, hydrocaulus with canaliculate coenosarc, regularly segmented, segments short. Each stem segment with two opposite apophyses and about 10 nematothecae, two nematothecae on each apophysis. Apophyses of adjacent segments slightly twisted resulting in hydrocladia being in two times two lateral rows, hydrocladia held laterally and giving impression of stem being pinnate. Hydrocladia up to 12 mm and with up to 16 hydrothecae, segmented homomerously with distinct oblique nodes, segments long, only at ends weakly developed annular thickenings (internal ribs). Hydrotheca elongate cup-shaped, opening at right angle. Three nematothecae per segment, two lateral and one inferior median nematotheca. Nematothecae conical, straight walls, movable, two-chambered, adcauline side somewhat lowered. No gonothecae present.

Dimensions:

Hydrocaulus diameter: 0.5 mm

Hydrocladial segments: 0.6 mm

Hydrotheca depth: 0.3 mm

Hydrotheca diameter: 0.11 mm

Lateral nematotheca: 80 µm

Remarks: Due to the absence of gonothecae, this material was not identified to species level. It strongly resembles *N. cylindrica* (Kirchenpauer, 1876) and *N. indivisa* (Allman, 1883). According to Watson (2000: 51), these two species are hardly distinguishable in the absence of gonothecae. Their gonothecae are quite different, though (for descriptions of *N. cylindrica* see Kirchenpauer, 1876; Watson, 2000; for *N. indivisa* see Allman, 1883; Billard, 1908b, 1913; Schuchert, 2003). The presence of two nematothecae on the stem apophyses favours *N. cylindrica* (4 in *N. indivisa*). The dimensions of the present material slightly surpass the values found in both species: e. g. the segment lengths are 0.6 mm, versus maximally 0.46 and 0.52 mm.

Nemertesia spec. 2

Fig. 21

Material: MHNG-INVE-89123; Japan, Okinawa Islands, SE of Kume Island, 26.2624°N 126.857°E, 150-168 m; 12.11.2009; one stem, without gonothecae.

Diagnosis: Stem 6 cm, unbranched, polysiphonic (including hydrocladia bearing part), thinning out to monosiphonic, main tube with canaliculate coenosarc,

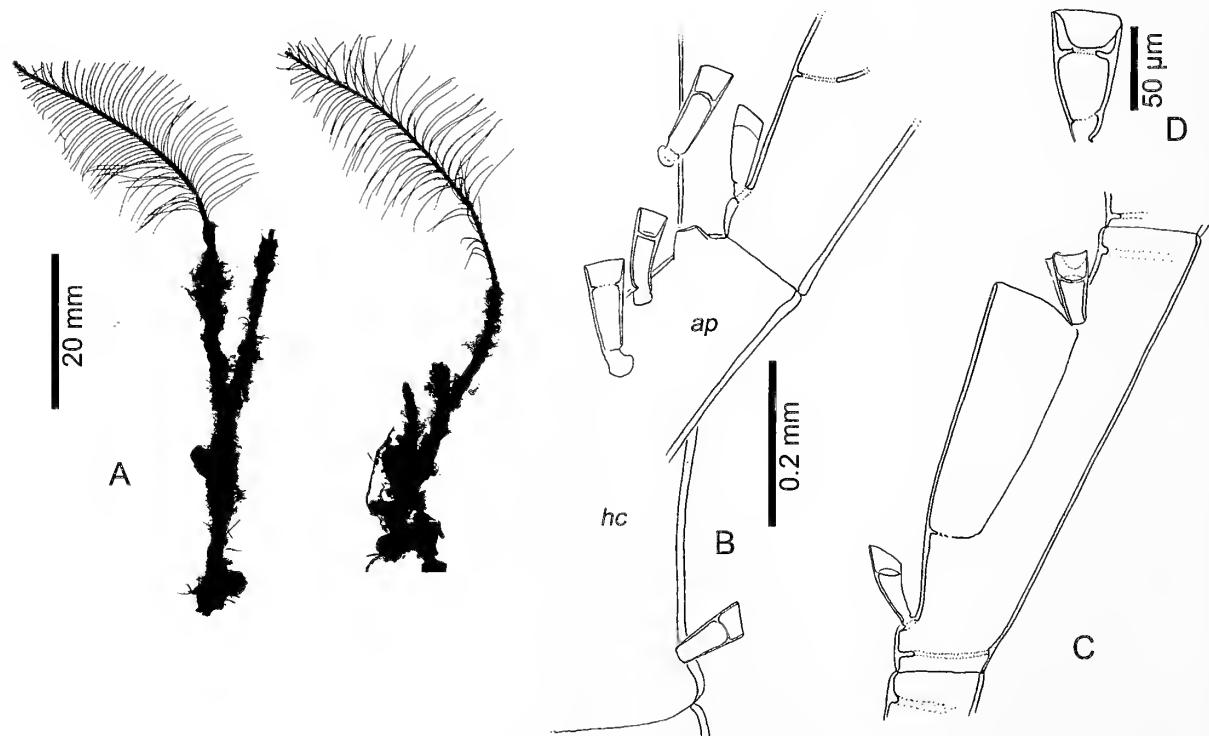


Fig. 20. *Nemertesia* spec. 1, MHNG-INVE-91092. (A) Colony silhouettes, note that the stem bases are heavily overgrown by foreign organisms. (B) Part of hydrocaulus (*hc*) segment with apophysis (*ap*) followed by begin of hydrocladium. (C) Segment of hydrocladium, note that there are no ahydrothecate segments; same scale as B. (D) Lateral nematotheca seen from adcauline side.

nodes absent. Auxiliary tubes thinner than main tube, with a row of tubercles bearing a pair of nematothecae. Hydrorhiza a tangled mass of thin, stolons anchoring colony in sediment. Hydrocladia held laterally giving impression of stem being pinnate, hydroeladia in two times two rows, 2-3 hydrocladia per whorl. Hydrocladia up to 6 mm and with up to 13 hydrothecae, segmented homomerously with distinct transverse nodes, segments long, with 7-9 conspicuous internal thickenings (ribs). Hydrotheca elongate eup-shaped, opening slightly tilting towards abcauline. Three nematothecae per segment, two lateral and one inferior median nematotheca. Nematothecae long, conical, straight walls, movable, two-chambered, adcauline side somewhat lowered. No gonothecae present.

Dimensions:

Hydrocladial segments: 0.48-0.49 mm

Hydrotheca depth: 0.16-0.21 mm

Hydrotheca diameter: 70-90 µm

Lateral nematotheca: 100-110 µm

Remarks: The present material is likely not fully grown. It is rather distinct from the previous sample and it matches partially the description of *N. japonica* given by Hirohito (1995), except for the depth of the hydrotheca and its opening angle. In the present

material, it is more than two times as deep as in the material of Hirohito from the South China Sea. Additionally, the opening is somewhat inclined towards abcauline instead of being perpendicular to the hydroeladium and the nematothecae appear also longer. Due to the infertile condition and the limited material it was here not identified to the species level.

Genus *Plumularia* Lamarck, 1816

Plumularia habereri Stechow, 1909

Fig. 22

Plumularia habereri Stechow, 1909: 77, pl. 6 fig. 4. – Stechow, 1913: 91, figs 59-60. – Ryland & Gibbons, 1991: 532: fig. 5. – Ansín Agès et al., 2014: 806, figs 9-13.

Plumularia habereri var. *attenuata* Billard, 1913: 42, fig. 34.

Plumularia habereri var. *mucronata* Billard, 1913: 46, fig. 40, pl. 2 fig. 24.

Dentitheca habereri. – Hirohito, 1995: 259, fig. 87a-c.

Not *Plumularia habereri*. – Schuchert, 2003: 211, fig. 60. [= *Plumularia elongata* Billard, 1913]

Not *Dentitheca habereri*. – Di Camillo et al., 2010: 84, figs 2, 3, 5, 6. [= *Plumularia elongata* Billard, 1913]

Material: MHNG-INVE-60992; Japan, Okinawa Island, Mizugama, 26.3590°N 127.7386°E, 9 m; 13.05.2008; almost all nematothecae lost, 11 cm colony, no gonothecae. – MHNG-INVE-60993; Japan, Shikoku Island, Kochi pref., Otsuki, Kochi, 32.7742°N 132.7250°E; 26 m; 26.01.2008; 3.2 cm colony fragment, no gonothecae. – MHNG-INVE-91090; Japan, Okinawa Islands, Okinawa, Cape Hedo, 26.8719°N 128.2657°E, 19.5 m; 21.06.2008, 3 sterile colonies.

Diagnosis: *Plumularia* species forming rather stiff colonies resembling those of Aglaopheniidae, sized

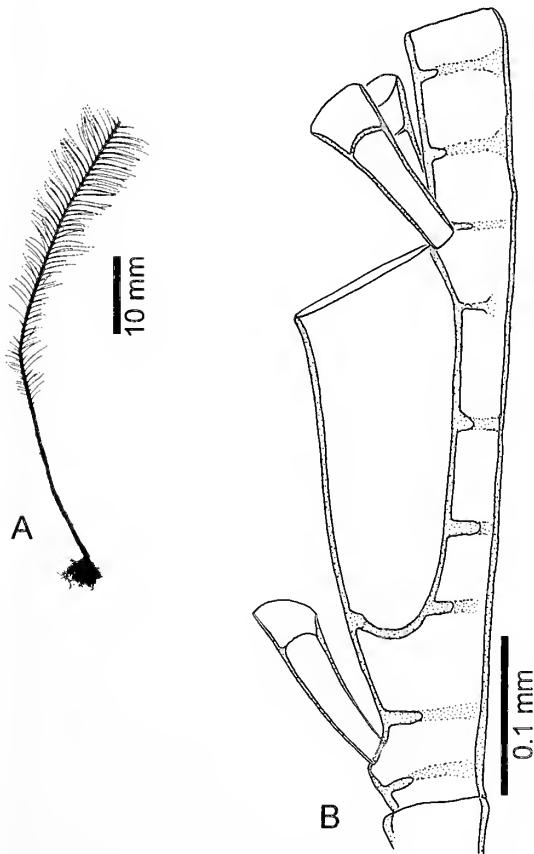


Fig. 21. *Nemertesia* spec. 2, MHNG-INVE-89123. (A) Colony silhouette, distalmost part lost. (B) Hydrocladial segment.

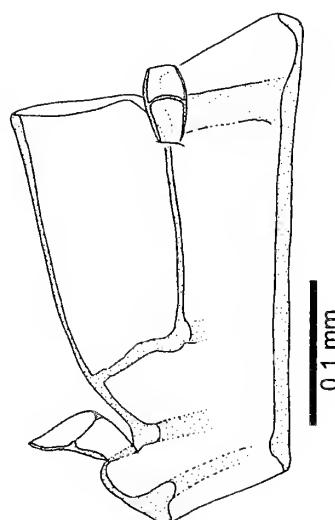


Fig. 22. *Plumularia habereri*, MHNG-INVE-60993; hydrocladial segment.

from a few cm to 28 cm in height, branching in one plane, multipinnate, polysiphonic stem and branches when fully grown. Hydroeladia with homomerous segmentation, short segments, hydrotheca tubular, parallel to segment axis, opening perpendicular to segment axis, deeper than wide, 0.15-0.23 mm deep, adcauline rim deeply lowered. All nematothecae movable and two-chambered. Median inferior nematotheea on bulge of segment. Lateral nematothecae ovoid, reaching above hydrothecal margin. Segment with 3-5 internal ribs, variable. Gonothecae small, on stem apophyses, shaped like inverted cones.

Type locality: Japan, Sagami Bay, Between Ito and Hatsushima Island, depth 150 m (Stechow, 1909).

Distribution: Japan, Philippines, Guam, Indonesia, Chesterfield Island, New Caledonia, and the Coral Sea, depth range 17-460 m (Ansín *et al.*, 2014).

Remarks: The sample 60992 from Okinawa lacks almost all nematothecae. The rather well preserved state of the polyps suggests that the nematothecae have been lost before the colony was collected. Without the nematothecae, this material can be quite difficult to recognize as a *Plumularia* species. A comparison with typical samples from other localities (Fig. 22) showed that it is otherwise identical.

Plumularia habereri has been interpreted as a rather variable species (Schuchert, 2003), although Billard (1913) distinguished and named several varieties, some of which are more likely distinct species (see Ansín Agís *et al.*, 2014). The current material corresponded to the typical form described by Stechow (1909, 1913).

Genus *Sibogella* Billard, 1911

Sibogella erecta Billard, 1911

Fig. 23A-B

Sibogella erecta Billard, 1911: 108. – Billard, 1913: 61, fig. 51, pl. 3 fig. 32. – Hirohito, 1969: 27, fig. 18. – Hirohito, 1995: 282, fig. 97g. – Schuchert, 2003: 217, fig. 64. *Stechowia armata* Nutting, 1927: 230, pl. 46 figs 1-2.

Material: MHNG-INVE-69622; Japan, Okinawa Islands, S of Kume Island, 26.24542°N 126.81745°E, 141-165 m; 20.11.2009; colony fragments without gonothecae.

Diagnosis: Plumulariidae with monosiphonic stem, few cm up to 13 cm, main stem with weak nodes, each with a side-branch. Side-branches alternate pinnate or spirally arranged. Side-branches indistinctly segmented, each segment with a sub-terminal apophysis for the attachment of a hydrocladium, stem segments with variable number of nematotheea, 1-2 on main part of segment, 1-3 in upper axil of apophysis, prominent mamelon on apophysis. Hydroeladia modified, flexible,

with heterogeneous segmentation, first segment with or without nematotheca, followed by segment with hydrotheca and the three usual nematothecae, followed by a variable number of up to 2-12 slender segments with 0-2 long nematothecae. Nematothecae all movable, conical, two-chambered, sizes variable. Hydrotheca relatively shallow, wider than deep, adaxial wall adnate to segment, abaxial wall everted, rim smooth. Gonotheca about 0.35 mm, in upper axils of apophyses of side-branches, pyriform.

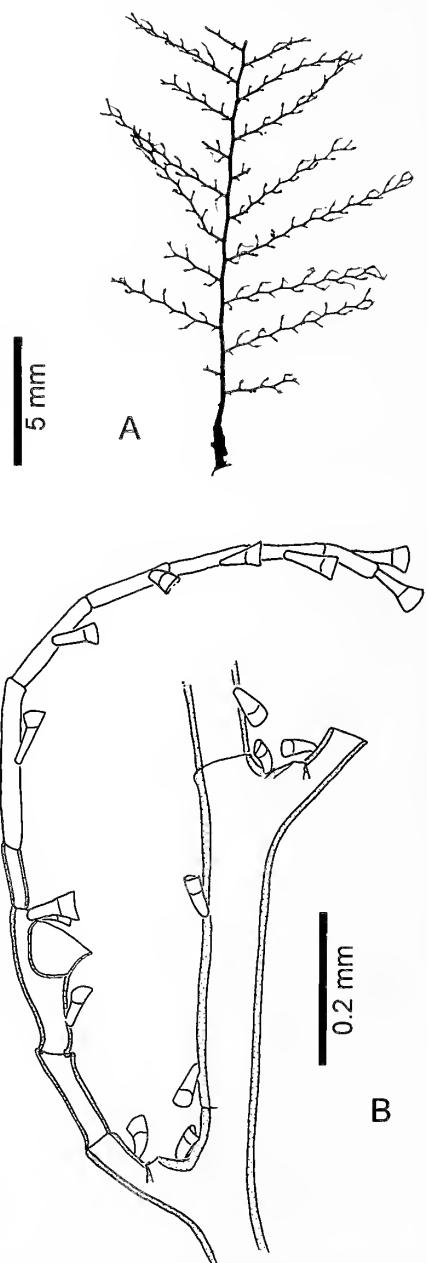


Fig. 23. *Sibogella erecta*, MHNG-INVE-69622. (A) Colony silhouette. (B) Part of side-branch with a modified hydrocladium on left apophysis.

Type locality: Indonesia, between Misool Island and New Guinea, 1.7083°S 130.7917°E, depth 32 m (Billard, 1913).

Distribution: Indonesia, Philippines, Japan (Schuchert, 2003).

Remarks: *Sibogella erecta* with its modified hydrocladia (Fig. 23B) is rather distinct among the Plumulariidae and easily identifiable. The present sample showed some variations when compared to previous description of the species (Billard, 1913; Hirohito, 1995; Schuchert, 2003). The first segment of the hydrocladium (Fig. 23B) always lacked a nematotheca, while it had one in other samples. The segments of the side-branches (Fig. 23B) had usually two nematothecae, while Billard (1913) reported a single one only. Also the apophyses are longer. All these differences are likely only population differences (intraspecific variation).

Family Aglaopheniidae Marktanner-Turneretscher, 1890

Genus *Aglaophenia* Lamouroux, 1812

Aglaophenia cupressina Lamouroux, 1816

Fig. 24

Aglaophenia cupressina Lamouroux, 1816: 169. — Billard, 1913: 107, fig. 96; pl. 6. — Vervoort, 1941: 233, fig. 11, distribution review. — Millard, 1975: 408, fig. 128A-C. — Schuchert, 2003: 242, fig. 81.

Plumularia bipinnata Lamarck, 1816: 126. — Billard, 1907: 331, synonym.

Aglaophenia macgillivrayi Busk, 1852: 400. — Allman, 1883: 34, pl. 10, pl. 20 figs 4-6. — Billard, 1909: 331, synonym.

Corbulifera macgillivrayi. — Naumov, 1969: 530, figs 380-381.

Material: MHNG-INVE-91091; Japan, Okinawa Island, Cape Hedo, 26.8719°N 128.2657°E, 5 m; 22.06.2008; one fertile colony.

Diagnosis: Large (7-20 cm) colonies, polysiphonic, multipinnate, dense, reminiscent of a fir twig, coenosarc with dense population of zooxanthellae. Hydrotheca relatively small and narrow, narrower than diameter of hydrocladium, depth 0.25-0.30 mm, diameter 0.13-0.15 mm, campanulate, not curved, adcauline side completely adnate. Median inferior nematotheca very stout, breadth in lateral view 2/3 or more of hydrothecal diameter, completely adnate, reaching to the level of hydrothecal rim, with thick, adcauline intrathecal shelf. Hydrocladium with strong internal ribs. Gonothecae in closed corbulae, corbulae 1.7-2.5 mm long.

Description: See Schuchert (2003).

Type locality: Indonesia ("East India", Lamouroux, 1816).

Distribution: Indo-Pacific in warmer waters; from Zanzibar and Mozambique to Great Barrier Reef,

Indonesia, New Guinea, Philippines, Sea of Okhotsk, and Kuriles (Vervoort, 1941; Naumov, 1969; Schuchert, 2003). Occurs even in very shallow water (1 m), but Billard (1913) found it down to 564 m.

Remarks: This species has been reported for Japan as *Corbulifera macgillivrayi* by Naumov (1969), however, it is not clear on what he based this record. Hirohito (1995) did not include *A. cupressina* in his list of Japanese *Aglaophenia* species. The present work is thus likely the first voucher record of *A. cupressina* for Japanese waters.

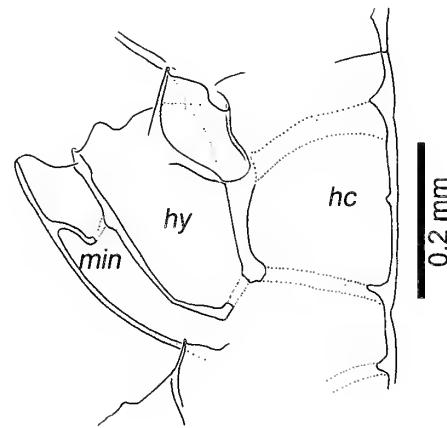


Fig. 24. *Aglaophenia cupressina*, MHNG-INVE-91091. Abbreviations: hc hydrocladium, hy hydrotheca, min median inferior nematotheca

Genus *Cladocarpus* Allman, 1874

Cladocarpus bocki Jäderholm, 1919

Figs 25A-H, 26A-D

Cladocarpus bocki Jäderholm, 1919: 24, pl. 6 figs 3-4. — Hirohito, 1983: 76, fig. 39. — Hirohito, 1995: 287, fig. 100a-c.

Material: MHNG-INVE-69643; Japan, Okinawa Islands, near Kume Island, 26.3231°N 126.7439°E, 68-99 m; 14.11.2009; one fertile colony (male), hydrorhiza with attached sand. — MHNG-INVE-69662; Japan, Okinawa Islands, near Kume Island, 26.28973°N 126.85767°E, 88-105 m; 10.11.2009; one infertile colony.

Diagnosis: *Cladocarpus* with branched, multi-pinnate colony. In addition to the three standard frontal nematothecae surrounding the hydrotheca, there is an additional single median nematotheca on the rear side of the segment. Hydrotheca long, tubular, rim smooth except for a single adcauline tooth. Long phylactocarps arise basiolateral of hydrothecae, with tubular nematothecae in four rows, with up to 8 gonothecae.

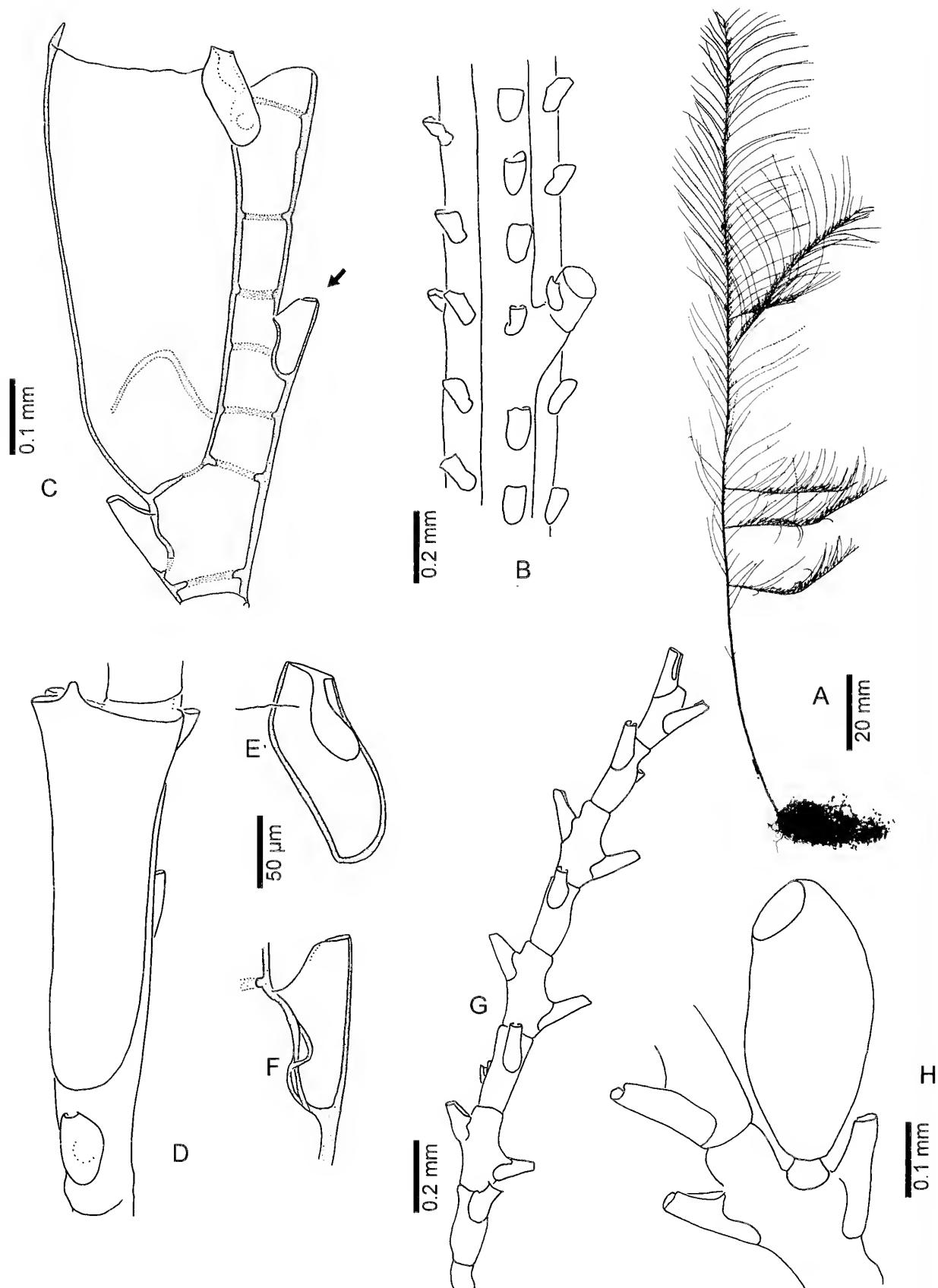


Fig. 25. *Cladocarpus bocki*, MHNG-INVE-69643. (A) Colony silhouette. (B) Polysiphonic branch with one apophysis and rest of broken hydrocladium. (C) Hydrothecate segment, note rear median nematotheca (arrow). (D) Frontal view of Hydrotheca (drawn opaque). (E) Lateral nematotheca seen from adcauline side. (F) Nematotheca on rear side of internode, same scale as E. (G) Phylactocarp without gonothecae. (H) Gonotheca and part of a phylactocarp.

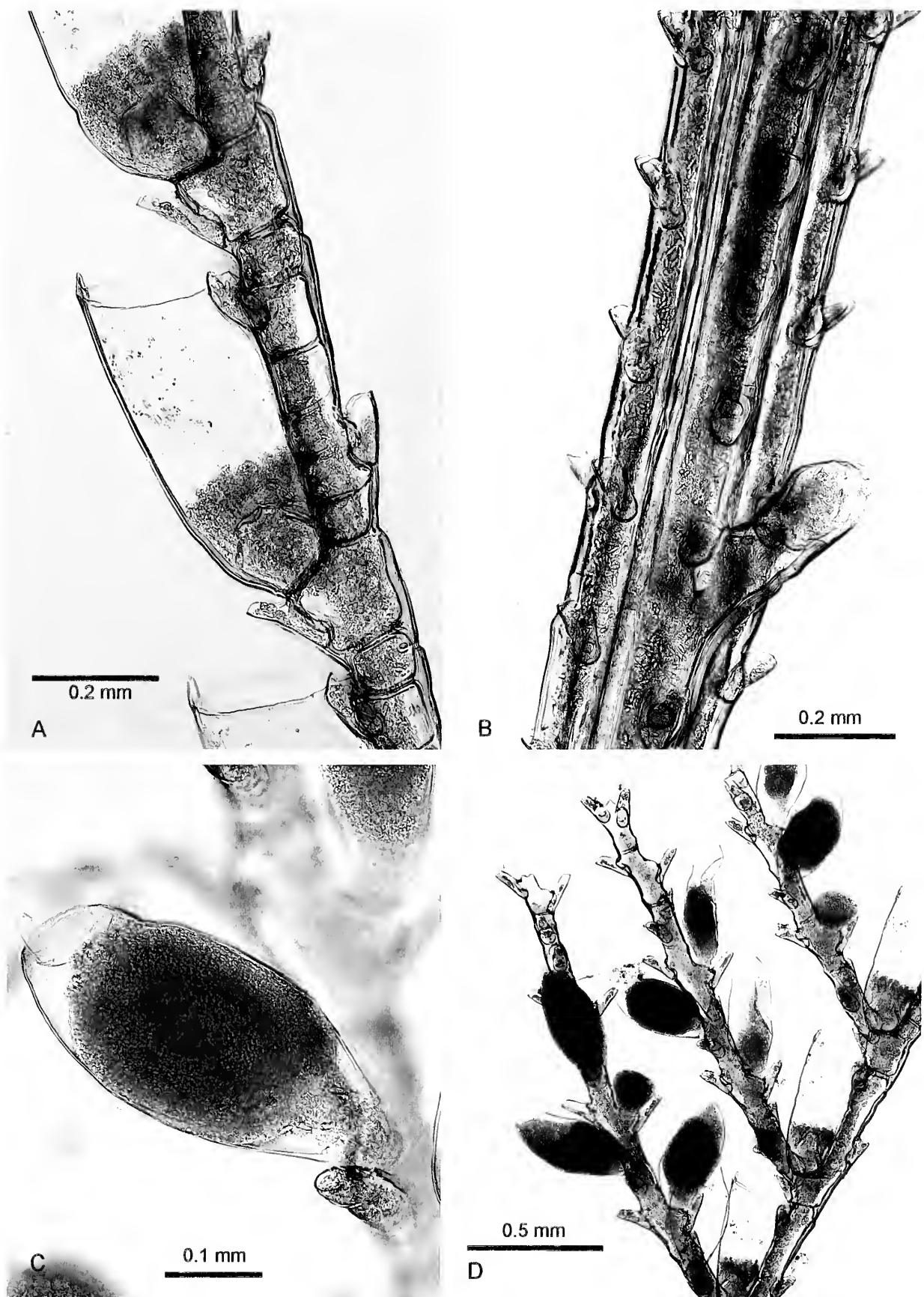


Fig. 26. *Cladocarpus bocki*, MHNG-INVE-69643. (A) Hydrothecate segment, note rear median nematotheca. (B) Polysiphonic branch with one apophysis and rest of broken hydrocladium. (C) male gonotheca. (D) Three phylactocarps bearing gonothecae.

Description: Colony erect, branched, multi-pinnate, hydrocladia alternate, the two rows forming an acute angle (Fig. 25A), stem polysiphonic, arising from a root-like hydrorhiza formed by tubular stolons which anchors the colony in the sediment.

Stem composed of a main tube and numerous auxiliary tubes, thinning out towards distal to monosiphonic condition. Main tube without distinct nodes, with regular apophyses for the hydrocladia and a row of adnate, scoop-shaped nematothecae (Figs 25B & 26B). Auxiliary tubes with one row of adnate nematothecae (Figs 25B & 26B). Hydroeladia long and flexible, homomerously segmented, up to 14-17 segments, each segment (internode) with a deep, campanulate hydrotheca, diameter towards opening slightly increasing, abcauline straight, margin smooth except for a distinct, abcauline tooth. On inside of hydrotheea in lower third a loop-shaped ridge, length variable. Median inferior nematotheca short, reaching just beyond floor of hydrotheca, the pair of lateral nematothecae drop-shaped, upright (Figs 25E). On rear side of segment in median line, a single, adnate, gutter-shaped nematotheca (Figs 25C, 25F, 26A). Each segment with 6-7 distinct internal perisarc ribs.

Gonothecae borne on phylactocarps which arise just lateral to hydrotheca base (Figs 25G, 26D). Phylactocarps develop on the first three segments of the hydrocladium. Phylactocarp composed of up to 8 segments, each with two tubular nematothecae, alternating in positions resulting in four rows of nematothecae. Each segment of the phylactocarp can bear a gonotheca. Gonotheca ellipsoid, opening terminal but oblique (Figs 25I & 26C). Nematocysts: small tentacular capsules (type not identified); large, rounded microbasic heteronemes which can be interpreted as isorhizas or euryteles.

Measurements:

Colony size: up to 200 x 50 mm

Diameter of main tube: 160 µm

Distance of hydrocladia of one side: 2.4-2.6 mm

Length of hydrocladial segments: 640-700 µm

Hydrotheca opening diameter: 220-230 µm

Depth of hydrotheca: 520-540 µm

Height lateral nematotheca: 130-150 µm

Size median inferior nematotheca: 110-140 µm

Side rear nematotheca: 100-120 µm

Length phylactocarp: 2.1-2.3 mm

Gonotheca: (0.40-0.48)x(0.17-0.20) mm

Small tentacular capsules: (2)x(5-6) µm

Large microbasic heteroneme: (6.5-8)x(21-22) µm

Type locality: Okinoshima Island, Kyushu province (Jäderholm, 1919).

Distribution: Okinoshima Island, Sagami Bay (Hirohito, 1983), Nijijima Island (Hirohito, 1983), Okinawa Islands (this study).

Biology: On sandy bottoms, known depth range 50-105 m (Hirohito, 1983; this study).

Cladocarpus unilateralis new spec.

Figs 27A-H-28A-E

Holotype: MHNG-INVE-69642, one colony, fertile, 26.2451°N 126.8573°E, Japan, Okinawa Islands, SE Kume Island, 179-192 m, 20.11.2009, triangular dredge.

Diagnosis: *Cladocarpus* with hydrocladia in a single helical row; stem branched, polysiphonic; pair of lateral nematotheeae gutter-shaped, very long and clasping hydrothecal margin; a single, lateral supplementary nematotheca in about middle of hydrothecate segment; hydrotheca long, tubular, rim smooth except for a single abcauline tooth. Phylactocarps arising basiolateral of hydrothecae and on opposite side of supplementary nematotheca, with tubular nematothecae in four rows, with a single gonotheca with recurved distal end.

Etymology: The specific epithet is refers to the supplementary nematotheca found on one side only.

Description: Colony erect, branched, hydrocladia arranged in a spiral (Fig. 27A), stem polysiphonic, helical, arising from a root-like hydrorhiza formed by tubular stolons. Stem composed of a main tube and numerous auxiliary tubes, thinning out towards distal to monosiphonic condition. Main tube without distinct nodes, with regular apophyses for the hydrocladia and a row of exserted, beaker-shaped nematothecae. Auxiliary tubes with one or more rows of tubular nematothecae sunken into perisarc (Fig. 27B).

Hydrocladia long and flexible, homomerously segmented, 10-15 segments, each segment (internode) with a deep, nearly tubular hydrotheca, diameter towards opening slightly increasing, abcauline wall in side-view undulated, wall in frontal view slightly s-curved, margin smooth except for a distinct, abcauline tooth. In lower third on inside of hydrotheea two loop-shaped ridges. Median inferior nematotheea short, almost completely adnate, reaching just beyond floor of hydrotheca; the two lateral nematothecae elongated, gutter-shaped, clasping hydrotheca along rim leaving only a small median region uncovered (Fig. 27C-D). A single supplementary nematotheca is present on the side of each segment, it is adnate and eup-shaped (Fig. 27C-D). This unilateral supplementary nematotheca is always on the same side of the hydrocladium and also for an entire branch. However the side is different in the two branches of the stem (Fig. 27A). Internodes with 6-7 distinct internal perisarc ribs. Gonothecae borne on phylactocarps which arise just lateral to hydrotheca base (Fig. 27G), always on opposite side of supplementary nematotheca. A single gonotheca per phylactocarp on first segment of phylactocarp. Gonotheca with distal part recurved, often almost 180°, hood-like (Fig. 27G-H). Phylactocarp composed of about four segments, each with two tubular nematothecae, alternating in positions resulting in four rows of tubular nematothecae.

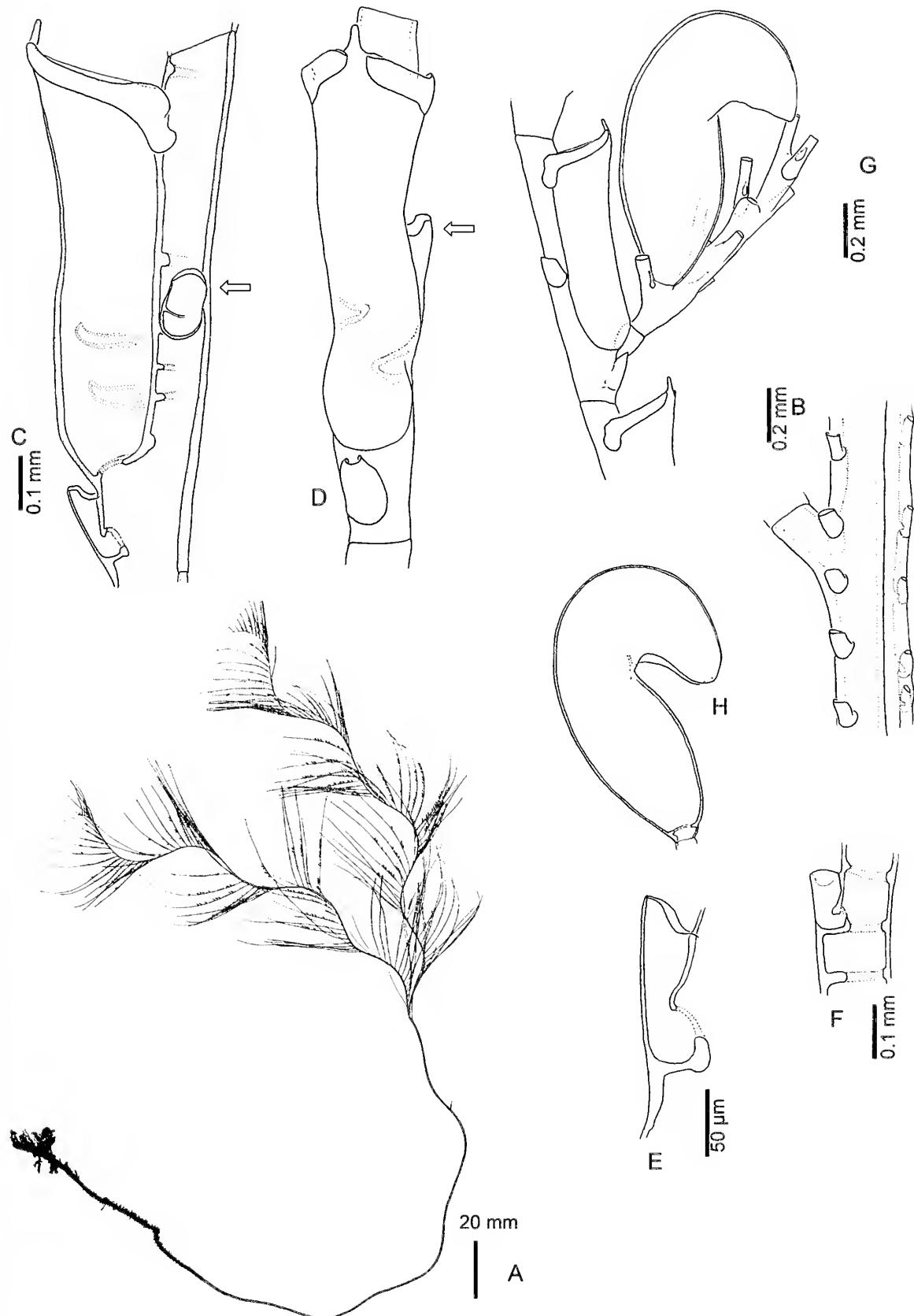
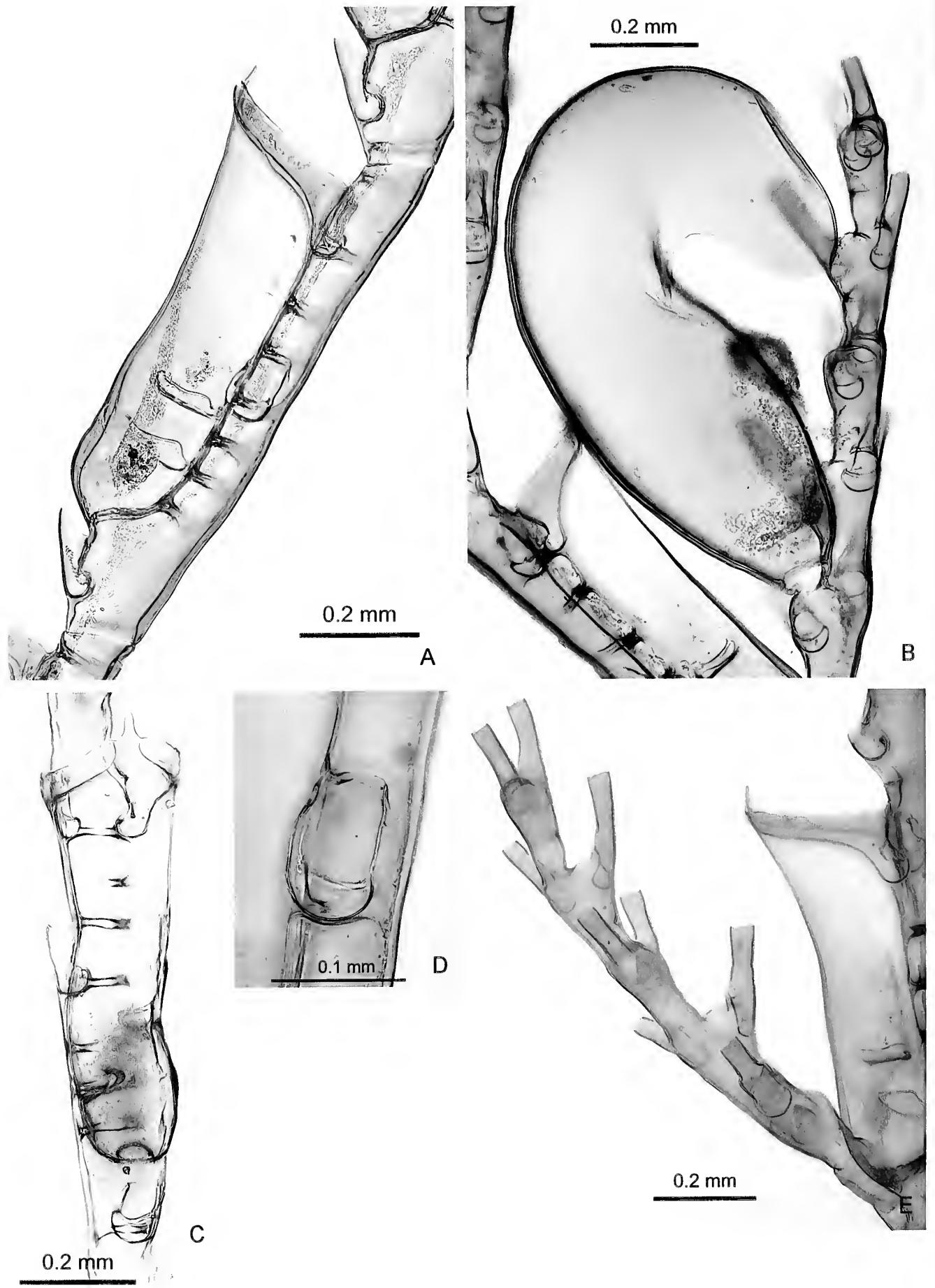


Fig. 27. *Cladocarpus unilateralis* new spec., holotype. (A) Colony silhouette. (B) Part of polysiphonic stem with main tube in front (with apophysis) and an auxiliary tube in rear. (C) Hydrothecate segment in lateral view, note lateral median nematotheca (arrow). (D) Hydrothecate segment in frontal view, note lateral median nematotheca (arrow); same scale as C. (E) Median inferior nematotheca of hydrothecate segment. (F) Unilateral nematotheca of hydrothecate segment seen from rear side. (G) Hydrothecate segment with phylactocarp bearing a gonotheca. (H) Gonotheca in side view; same scale as G.



Measurements:

Colony size: 36 cm high
 Diameter of main tube: 180 μm
 Distance of hydrocladia: 2.5-3 mm
 Length of hydrocladial segments: 0.85-1.0 mm
 Hydrotheca opening diameter: 0.22-0.24 mm
 Depth of hydrotheca: 0.67-0.74 mm
 Height lateral nematotheca: 70-80 μm
 Length lateral nematotheca: 280-310 μm
 Size median inferior nematotheca: 140 μm
 Side rear nematotheca: 120 μm
 Length phylactocarp: 2.2 mm
 Gonotheca: 1 mm

Type locality: Japan, Okinawa Islands, SE of Kume Island, 26.2451°N 126.8573°E, 179-192 m.

Distribution: Okinawa Islands.

Remarks: The most conspicuous feature of this species is the spiral arrangement of the hydrocladia (Fig. 27A), contrasting with a strictly pinnate arrangement seen in other congeners (e. g. Fig. 25A, *C. bocki*). This spiral arrangement of the hydrocladia has been deemed diagnostic to separate the genus *Streptocaulus* Allman, 1883 from *Cladocarpus* Allman, 1874 (e. g. Bouillon *et al.*, 2006). The use of this character was rebutted by Ramil & Vervoort (1992b) because the type species of *Streptocaulus* (*S. pulcherrimus* Allman, 1883) has also pinnate growth stages. Ramil & Vervoort (1992b) used the different types of phylactocarps seen in the type species of both *Cladocarpus* and *Streptocaulus* to separate the genera. This was critiqued by Schuchert (2001), as some phylactocarps are intermediate and they are not unambiguously classifiable. A revision of the aglaopheniid genera is highly warranted, but for credible results it is mandatory to base such a revision on a robust molecular phylogeny. A single morphological difference alone is insufficient. Until such a phylogeny based revision is available, I prefer to regard *Streptocaulus* as a synonym of *Cladocarpus*.

At first glance, *Cladocarpus unilateralis* appears somewhat similar to *C. bocki*. But while in the latter species the supplementary hydrotheca is on the rear side of the internode, it is lateral in the present species. Further differences can be found in the form of the paired lateral nematothecae, the number of gonothecae per phylactocarp, the shape of the gonotheca, and also the arrangement of the hydrocladia. The unilateral nematotheca makes *Cladocarpus unilateralis* n. spec. rather unique among its congeners. Other similar species, e. g. *Cladocarpus corneliusi* Ramil & Vervoort, 1992 or *Cladocarpus boucheti* Ramil & Vervoort, 1992, have also supplementary lateral nematothecae, but they are paired

(comp. Ramil & Vervoort, 1992a). These two species also differ in the shape of their upper, lateral nematothecae, as well as the shape of the gonotheca.

The long, lateral nematothecae clasping the hydrotheca are also rather unusual. Similar nematothecae, but with several openings and not with a gutter-shape, can be found in *C. stechowi* Ramil & Vervoort, 1992 and *C. anonymous* Ramil & Vervoort, 1992.

Genus *Gymnangium* Hincks, 1874***Gymnangium expansum* (Jäderholm, 1903)**

Fig. 29A-B

Halicornaria expansa Jäderholm, 1903: 303, pl. 14 figs 5-7. – Jäderholm, 1919: 26, pl. 6 fig. 7.

Halicornaria sibogae Billard, 1918: 25, fig. 4. – Rees & Vervoort 1987: 165.

Halicetta expansa. – Hirohito, 1995: 293, fig. 103a.

Gymnangium expansum. – Vervoort, 1966: 165, figs 65-66. – Rees & Vervoort, 1987: 163, fig. 3a-b. – Vervoort & Watson, 2003: 289, figs 68G & 69A.

Material examined: MHNG-INVE-69623; Japan, Okinawa Islands, 26.2454°N 126.8174°E, 141-165 m; 20.11.2009; infertile.

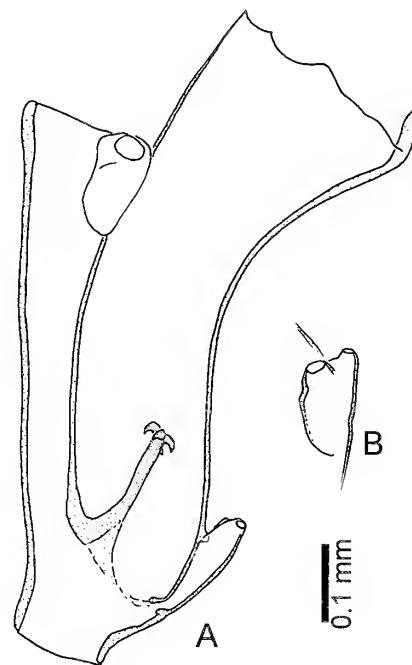


Fig. 29. *Gymnangium expansum*, MHNG-INVE-69623. (A) Hydrothecate segment in lateral view. (B) Median inferior nematotheca in oblique view, note terminal bifurcation; same scale as A.



Fig. 28. Microphotographs of *Cladocarpus unilateralis* new spec., holotype, Fast Blue stained permanent preparations except C. (A) Hydrothecate segment, note unilateral median nematotheca. (B) Phylactocarp with gonotheca. (C) Frontal view of hydrotheca. (D) Lateral view of unilateral nematotheca. (E) Phylactocarp.

Diagnosis: *Gymnangium* species with deep hydrotheca, longer than segment length, 1/3 of adcauline side free, curving away from segment, upper part of hydrotheca expanding, with one sharp, distinct abcauline tooth, 2-3 shallow lateral teeth on hydrothecal rim; adcauline septum often drawn out into a rod ending in a knob with hooks; end of median inferior nematotheca bifid (Fig. 29B).

Description: See Rees & Vervoort (1987).

Type locality: South of Japan, 29.30°N, 125.67°E, 104 m (Rees & Vervoort, 1987).

Distribution: Japan, New Zealand, Indonesia, eastern Africa (Rees & Vervoort, 1987; Vervoort & Watson, 2003).

Remarks: This is a characteristic species that can reliably be identified even in the absence of gonothecae (Fig. 29A-B).

Gymnangium roretzii
(Marktanner-Turneretscher, 1890)
Fig. 30A-K

Aglaophenia roretzii Marktanner-Turneretscher, 1890: 271, pl. 6 figs 22 & 22a.

Gymnangium roretzii. — Stechow, 1909: 102, pl. 6 fig. 18. — Hirohito, 1995: 290, fig. 101f.

Material examined: Part of holotype colony, NMW, registration number 6015, alcohol preparation, origin Japan, collected by Roretz, identified by Marktanner-Turneretscher, without further collection data. — MHNG-INVE-69634; Japan, Okinawa Islands, N of Kume Island, 26.3932°N 126.7535°E, 95.5-123 m; 19.11.2009; infertile. — MHNG-INVE-69645; Japan, Okinawa Islands, S of Kume Island, 26.2545°N 126.7946°E, 114-115 m; 13.11.2009; infertile.

Diagnosis: Similar to *G. allmani* (Marktanner-Turneretscher, 1890) and *G. hians* (Busk, 1852), but rim of hydrotheca with one pair of lateral cusps only, the cusps variable, often drawn out and recurved like a wing.

Description (Okinawa material): Colonies forming pinnate stems, monosiphonic, thick, mostly without distinct nodes. Hydrorhiza composed of few tubular stolons. Hydrocladia stiff, dense, regularly spaced (Fig. 30A), similar in length, alternate in position, both series in about the same plane, this plane tangential to stem and thus defining an anterior and posterior side of the plume.

Stem nematothecae associated with apophyses of hydrocladia in groups of three, two anterior and one axillar on rear side of plume; lower anterior sacciform, one elongated opening (Fig. 30E), upper anterior nematotheca sacciform with two openings, one elongate, the other on a conical protrusion (Fig. 30E); rear nematotheca on

upper axil sac-like, two openings, one opening elongate, the other on a very long, tubular appendage (Fig. 30F). Hydrocladia homomerously segmented (Fig. 30B-D), nodes indistinct, branch thick, hydrotheca almost as large as segment; hydrotheca cup-shaped, almost perpendicular to segment axis, relatively long free adcauline part, in about middle of abcauline wall a horizontal septum which spans at least 2/3 of diameter, septum somewhat concave, free rim of septum swollen and usually with teeth (Fig. 30B-C); rim of hydrotheca with one broad lateral cusp on each side, these variable but usually long and recurving and resembling two wings in frontal view (Fig. 30C-D); abcauline wall of hydrotheca often with a kink (Fig. 30B, D). The three usual nematothecae associated with the hydrotheca; the pair of lateral nematothecae sac-shaped to triangular, large adcauline opening (Fig. 30C); median inferior nematotheca very long (Fig. 30B-D), tubular, curved, spanning about 2/3 of hydrothecal opening, adnate along whole abcauline side of hydrotheca, with a terminal opening and an elongated opening on upper side where becoming free from hydrotheca.

Gonothecae absent in present material, see Hirohito (1995) for an illustration.

Measurements: Sample MHNG-INVE-69645 and holotype

Colony size: 12 cm

Diameter of main tube: 0.31-0.5 mm

Distance of hydrocladia of one side: 0.75-1.05 mm

Length of hydrocladial segments: 0.33-0.41 mm

Hydrotheca opening diameter: 0.18-0.29 mm

Depth of hydrotheca: 0.23-0.28 mm

Height lateral nematotheca: 80-150 µm

Size median inferior nematotheca: 125-230 µm

Type locality: Japan (Marktanner-Turneretscher, 1890).

Distribution: Japan.

Remarks: The new material from the Okinawa Islands was only hesitatingly attributed to *G. roretzii* as both available colonies lacked gonothecae. *Gymnangium roretzii*, a species only known from Japan, is somewhat difficult to separate from the Indo-Pacific *G. hians* (see Watson, 2000, description of material from close to type locality) as well as the Atlantic *G. allmani* (Marktanner-Turneretscher, 1890) (see Galea, 2013 for a recent description). While these two species have typically a hydrothecal rim with two pairs of teeth, *G. roretzii* has only one. It may be, however, rather variably developed (see Fig. 30G-I). Indo-Pacific *G. allmani* have also been described as having one pair of hydrothecal cusps only (Billard, 1913; Jäderholm, 1923; Millard, 1975). Galea (2013) regarded these Indo-Pacific *G. allmani* as distinct from the true *G. allmani* which is an Atlantic species. Perhaps some Pacific records of *G. allmani* could in fact belong to *G. roretzii*. Other, small differences can be found in the nematothecae of the stem, in particular

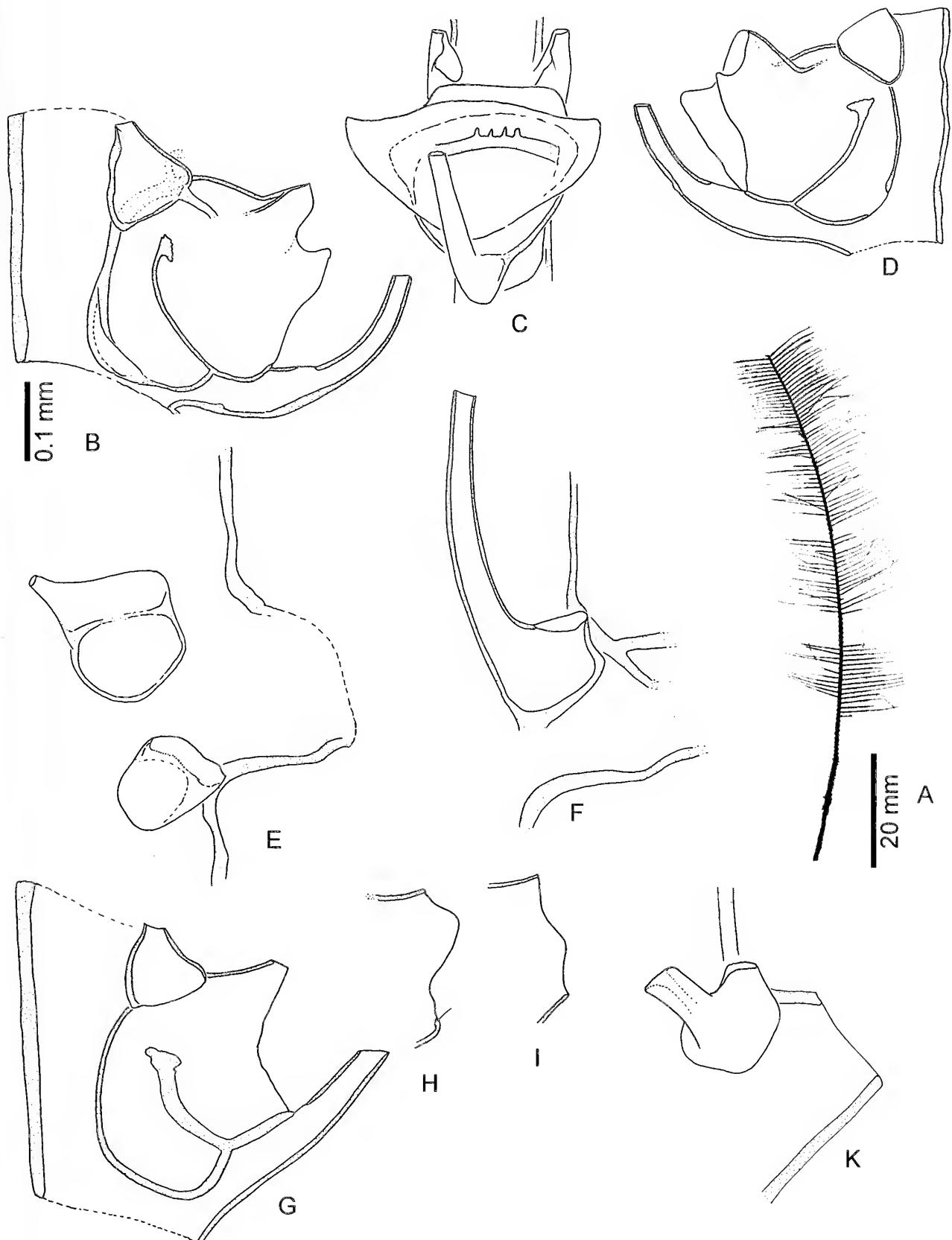


Fig. 30. *Gymnangium roretzii*, material from the Okinawa Islands, except G-K which is type material. Scale bar in B is valid for B through K. (A) Colony silhouette. (B) Lateral view of hydrothecate segment. (C) Frontal view of hydrothecate segment. (D) Oblique view of hydrothecate segment. (E) Apophysis of stem, frontal side, note two nematothecae. (F) Apophysis of stem, rear-side, note nematotheca with very long tubular process. (G) Lateral view of hydrothecate segment of holotype. (H-I) Variation of lateral cusps of hydrothecal rim, holotype. (K) Apophysis of stem, rear-side, note nematotheca with moderately long tubular process, holotype.

the one on the rear-side of the apophyses bearing the branches. While *G. allmani* has a flat, sac-like shape with several openings on short processes (Galea, 2013), it is simple like a lateral nematotheca in *G. hians* (see Watson, 2000). In *G. roretzii* it is also sac-like, but has two distinct openings: one elongate slit-like and one at the end of a tubular extension (Fig. 30F, K). In the new material, this axillar nematotheca differed significantly from the type material in that the tubular extension is very long and conspicuous (Fig. 30F). It is therefore possible that the present material could belong to a separate, unnamed species.

Genus *Lytocarpia* Kirchenpauer, 1872

Lytocarpia delicatula (Busk, 1852)

Fig. 31

Plumularia delicatula Busk, 1852: 396.

Aglaophenia delicatula. – Bale, 1884: 167, pl. 14 fig. 4, pl. 17 fig. 11. – Billard, 1913: 106, fig. 95. – Jäderholm, 1920: 8, pl. 2 fig. 7. – Watson, 2000: 57, fig. 46A-E.

Thecocarpus delicatulus. – Millard, 1975: 455, 139D-E.

Lytocarpia delicatula. – Schuchert, 2003: 235, fig. 76. – Di Camillo *et al.*, 2011: 527, figs 2d; 3c, f; 6e; 9a-g; 10a-i.

Material examined: MHNG-INVE-69635; Japan, Okinawa Islands, 26.3605°N 126.6876°E, 86-97 m; 19.11.2009; with developing corbulae. – MHNG-INVE-69656; Japan, Okinawa Islands, 26.3474°N 126.6886°E, 96-186 m; 19.11.2009; with developing corbulae.

Diagnosis: *Lytocarpia* species with monosiphonic, unbranched stem, usually 3-5 cm. Hydrotheca

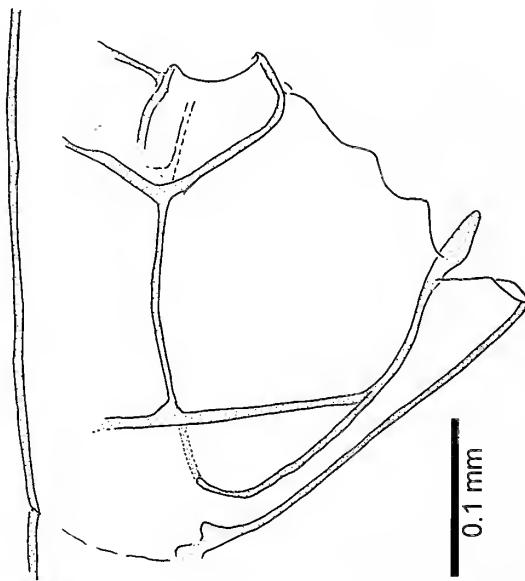


Fig. 31. *Lytocarpia delicatula* MHNG-INVE-69635, lateral view of hydrotheca.

campanulate, depth 0.21-0.23 mm; one sharp, long, thick abcauline tooth, rim with two broad lateral cusps on each side; with short adcauline shelf continued as ridge to abcauline wall. Median inferior nematotheca reaching same level as rim of hydrotheca. Corbula open, costae thin, not flattened, widely separated.

Description: Schuchert (2003), Di Camillo *et al.* (2011).

Type locality: Australia, Queensland, Torres Strait, Prince of Wales Channel, depth 16 m (Busk, 1852).

Distribution: Northern Australia, Great Barrier Reef, Australia, Indonesia, Seychelles, Maldives, Mozambique (Di Camillo *et al.*, 2011). New record for Okinawa Islands (this study).

Lytocarpia nigra (Nutting, 1906)

Fig. 32A-B

Thecocarpus niger Nutting, 1906: 953, pl. 5 fig. 5, pl. 13 figs 1-6. – Stechow, 1913: 96, figs 65-67.

Lytocarpia niger. – Rho, 1967: 346, fig. 7A-B, pl. 1 fig. 1.

Lytocarpia nigra. – Hirohito, 1995: 295, fig. 104c-e.

Material examined: MHNG-INVE-69663; Japan, Okinawa Islands, 26.3283°N 126.7160°E, 93-101 m; 19.11.2009; infertile. – MHNG-INVE-69630; Japan, Okinawa Islands, 26.3932°N 126.7535°E, 95.5-123 m; 19.11.2009; infertile.

Diagnosis: Similar to *L. delicatula*, but entire coenosarc of colony with black pigment, colony up to 20 cm, branched (multipinnate), stem polysiphonic. Hydrotheca deeply campanulate, depth about 0.33 mm, in lower half a horizontal ridge along inside of wall; cusps very tall, 9 in total, one curved median abcauline tooth, on each side four lateral cusps of which the three anterior ones are rounded and the fourth is pointed, the embayments between the median and the rounded cusps strongly everted and giving the rim of the hydrotheca a folded appearance (Fig. 32B). Corbula open, costae thin, not flattened.

Description: See Nutting (1906) or Stechow (1913).

Type locality: USA, Hawaii, Laysan Island (Nutting, 1906).

Distribution: Hawaii (Nutting, 1906), Sagami Bay (Stechow, 1913; Hirohito, 1995), Okinawa Islands (this study), Korea (Rho, 1967).

Lytocarpia orientalis (Billard, 1908)

Fig. 33

Thecocarpus myriophyllum var. *orientalis* Billard, 1908a: 73, fig. 1. – Billard, 1913: 91, fig. 76-78, pl. 5 fig. 43. – Jäderholm, 1919: 25, pl. 6 fig. 5.

Thecocarpus myriophyllum var. *elongatus* Billard, 1910: 51.

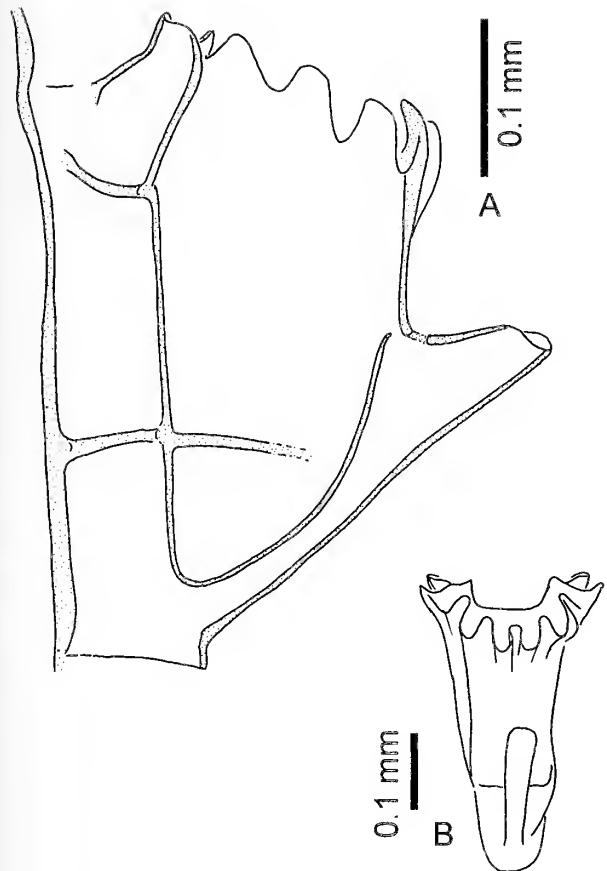


Fig. 32. *Lytocarpia nigra* MHNG-INVE-69663. (A) Lateral view of hydrotheca. (B) Frontal view of hydrotheca, note pleated rim.

Thecocarpus myriophyllum var. *angulatus* Billard, 1913: 94, figs 79-80.

Gymnangium unjinense Watson, 2000: 62, fig. 50A-E.

Lytocarpia orientalis. – Schuchert, 2003: 240, fig. 79.

Material examined: MHNG-INVE-87092; Japan, Okinawa Islands, 26.2454°N 126.8174°E, 141-165 m; 20.11.2009; infertile. – MHNG-INVE-88803; Japan, Okinawa Islands, 26.2776°N 126.8914°E, 151-160 m; 12.11.2009; with corbulae. – MHNG-INVE-69644; Japan, Okinawa Islands, 26.2838°N 126.8659°E, 126-136 m; 12.11.2009; with corbulae.

Diagnosis: *Lytocarpia* species resembling *L. myriophyllum* (Linnaeus, 1758), but stems never branched, median inferior nematotheca attached along 2/3 of abcauline wall of hydrotheca, free end reaching almost to rim level of hydrotheca. Costae of corbulae fused to form a tube, costae broad, flattened.

Description: See Schuchert (2003).

Type locality: Not designated, Billard's (1908a) two samples came from Indonesia, Borneo, 3.45°S 117.60°E 59 m depth, and north of the island Waigeo, 0.220°N 130.401°E 141 m depth (data from Billard, 1913).

Distribution: Japan, Indonesia, Philippines, northern Australia, Chile (Schuchert, 2003).

Remarks: The material matched very well the specimens described in Schuchert (2003). The species has already been recorded in Japanese waters by Jäderholm (1919).

Genus *Macrorhynchia* Kirchenpauer, 1872

Macrorhynchia balei (Nutting, 1906)

Fig. 34

Lytocarpus balei Nutting, 1906: 954, pl. 6: fig. 1, pl. 13: figs 7-8. – in part Stechow, 1909: 99, pl. 6: figs 12-13. – Billard, 1913: 81, fig. 66. – Nutting, 1927: 236. – Vervoort, 1941: 226, fig. 9.

not *Lytocarpus balei*. – Leloup, 1930: 8, fig. 6, pl. 1: fig. 3. – Hirohito, 1995: 297, fig. 105a-c. [= *M. philippina*]

? *Macrorhynchia philippina*. – Hirohito, 1983: 78, fig. 41. – Hirohito, 1995: 297, fig. 105d-g. [not *Macrorhynchia philippina* Kirchenpauer, 1872]

Macrorhynchia balei. – Schuchert, 2003: 226, fig. 71.

Material examined: MHNG-INVE-69640; Japan, Okinawa Islands, SE of Kume Island, 26.2836°N 126.9007°E, 142-149m; 13.11.2009; with gonothecae. – MHNG-INVE-89124; Japan, Okinawa Islands, SE of Kume Island, 26.2624°N 126.857°E, 150-168 m; 12.11.2009; sterile.

Diagnosis: *Macrorhynchia* species with pores in hydrocladial wall opposite of hydrotheca, these pores associated with bundles of long nematocysts (Fig. 34), more distal segments of the hydrocladium may lack the pore).

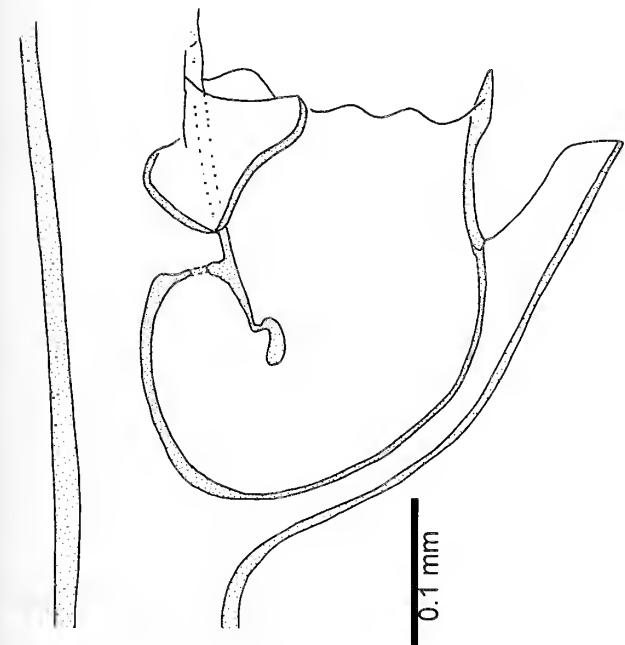


Fig. 33. *Lytocarpia orientalis* MHNG-INVE-69644, lateral view of hydrotheca.

Description: See Schuchert (2003).

Type locality: Off south coast of Molokai, Hawaiian archipelago, 86-210 m (Nutting, 1906).

Distribution: Hawaii (Nutting, 1906), Indonesia (Schuchert, 2003), Philippines (Nutting, 1927), Japan (Stechow, 1909; this study).

Remarks: The present samples was not separable from Indonesian material described by myself in 2003. The phylactocarps had two to eight gonothecae. The auxiliary tubes of the stems had rows of holes for nematophores.

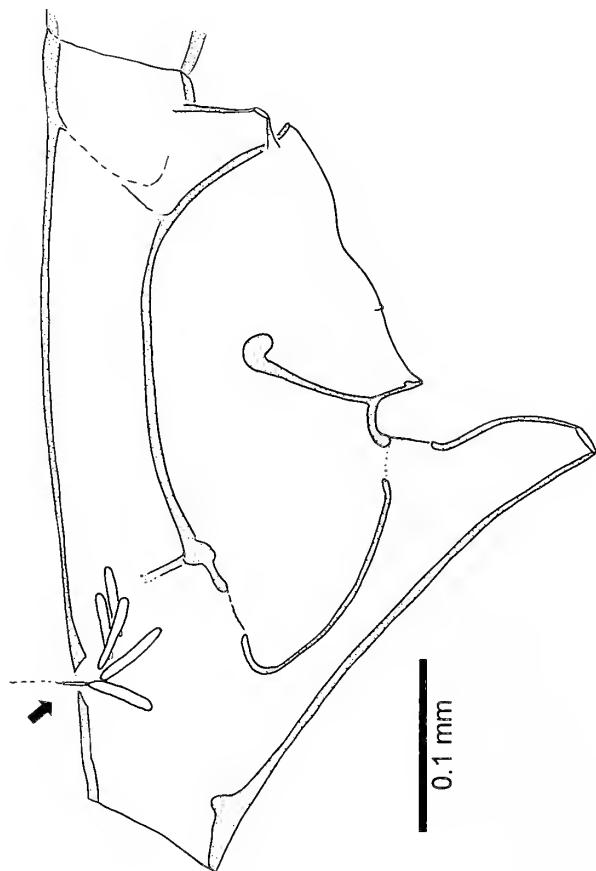


Fig. 34. *Macrorhynchia balei*, MHNG-INVE-69640, lateral view of hydrothecate segment, note the pore on the rear side (arrow) which serves as opening to discharge the large nematocysts which occur in clusters close to the opening (only a few capsules shown).

Macrorhynchia fulva Di Camillo, Puce & Bavestrello, 2009

Fig. 35A-E

Macrorhynchia fulva Di Camillo *et al.*, 2009: 13, figs 2C-E, 4A-G.

Material examined: MHNG-INVE-87091; Japan, Okinawa Islands, S of Kume Island, 26.2454°N 126.8174°E, 141-165 m; 20.11.2009; infertile. –

MHNG-INVE-69649; Japan, Okinawa Islands, SE of Kume Island, 26.2624°N 126.8570°E, 50-168 m; 12.11.2009; infertile.

Diagnosis: Like *Macrorhynchia phoenicea*, but with a distinct, tongue-like projection on adcauline side of hydrothecal rim (Fig. 35A, arrow) and lateral nematothecae whose openings are directed sideways in proximal segments (Fig. 35C).

Description: Colonies fan-shaped, regularly multi-pinnate, reaching heights of 10 cm and more, attached to a root-like hydrorhiza composed of tubular stolons. Stem and major side branches polysiphonic in basal part, thinning out to monosiphonic in distal part, in polysiphonic parts composed of a superficial primary tube bearing hydrocladia and several auxiliary tubes. Stem light brown to dark brown in older parts or colonies. Auxiliary tubes without nematothecae. Proximal portions of the primary tubes in stem and branches bearing frontal nematothecae only and no hydrocladia, these nematothecae like those in hydrocladia-bearing parts. Primary tube of stem with somewhat indistinct segmentation (nodes), each internode with a hydrocladium, hydrocladia alternating sides, associated with hydrocladium on frontal side of primary tubule are two nematothecae, sac-like with an oval distal opening and a conical, nematotheca-like process with a terminal opening (Fig. 35E). Near base of hydrocladium a mamelon (short, conical process with distal opening). Hydrocladia segmented by transverse nodes, up to 13 segments per hydrocladium, hydrocladia alternate, more or less parallel.

Hydrotheca large, bowl-shaped, no or almost no free ab- and adcauline sides, one large, thick intrathecal septum on abcauline side, its end thickened with irregular prickles. Inside hydrotheca, on upper adcauline wall a shallow, keel-like vertical septum which is continued externally as a characteristic, tongue-like process (Fig. 35A-D). Hydrothecal rim with one broad lateral tooth which is flaring. Behind hydrotheca three thick annular ridges.

Median inferior nematotheca tubular, tapering, overtopping hydrothecal opening but length variable, one terminal opening and one oval opening on adcauline side where fused to hydrotheca. Lateral nematothecae, small, volcano-shaped, terminal opening directed sideways in proximal segments (Fig. 35C), in the distal-most segments opening directed along the hydrocladial axis (Fig. 35D). Lateral nematothecae have a second, adcauline opening near base.

Reproductive structures not observed, for a description see Di Camillo *et al.* (2009).

Measurements: (in brackets values of type material according to Di Camillo *et al.*, 2009)

Colony size: height 5-10 cm (2.5 cm)

Diameter of main tube: 140-160 µm

Distance of hydrocladia: 0.55-0.58 mm (0.3-0.35 mm)

Length of hydrocladial segments: 0.26-0.27 mm (0.275-0.285 mm)

Hydrotheca opening diameter: 140-150 μm (185-190 μm)

Lateral nematotheca: 45-50 μm (80-145 μm)

Type locality: Indonesia, North Sulawesi, Bunaken National Marine Park, Mandolin, depth 18 m (Di Camillo *et al.*, 2009).

Distribution: Indonesia (Di Camillo *et al.*, 2009), Okinawa Islands (this study).

Remarks: The present material was assigned to

M. fulva due to the characteristic, tongue-like process of solid perisarc found at the adcauline rim of the hydrotheca (Fig. 35A-B). Some differences to the Indonesian material described by Di Camillo *et al.* (2009) were nevertheless observed. The lateral cusps of the hydrotheca are somewhat smaller and less flaring. More importantly, there are some obvious size differences (see Measurements above). These differences were interpreted as intraspecific variation. Di Camillo *et al.* (2009) give as a further diagnostic character of this species the “sideways directed lateral nematothecae”. In the here examined material they are not always directed sideways. In the more distal

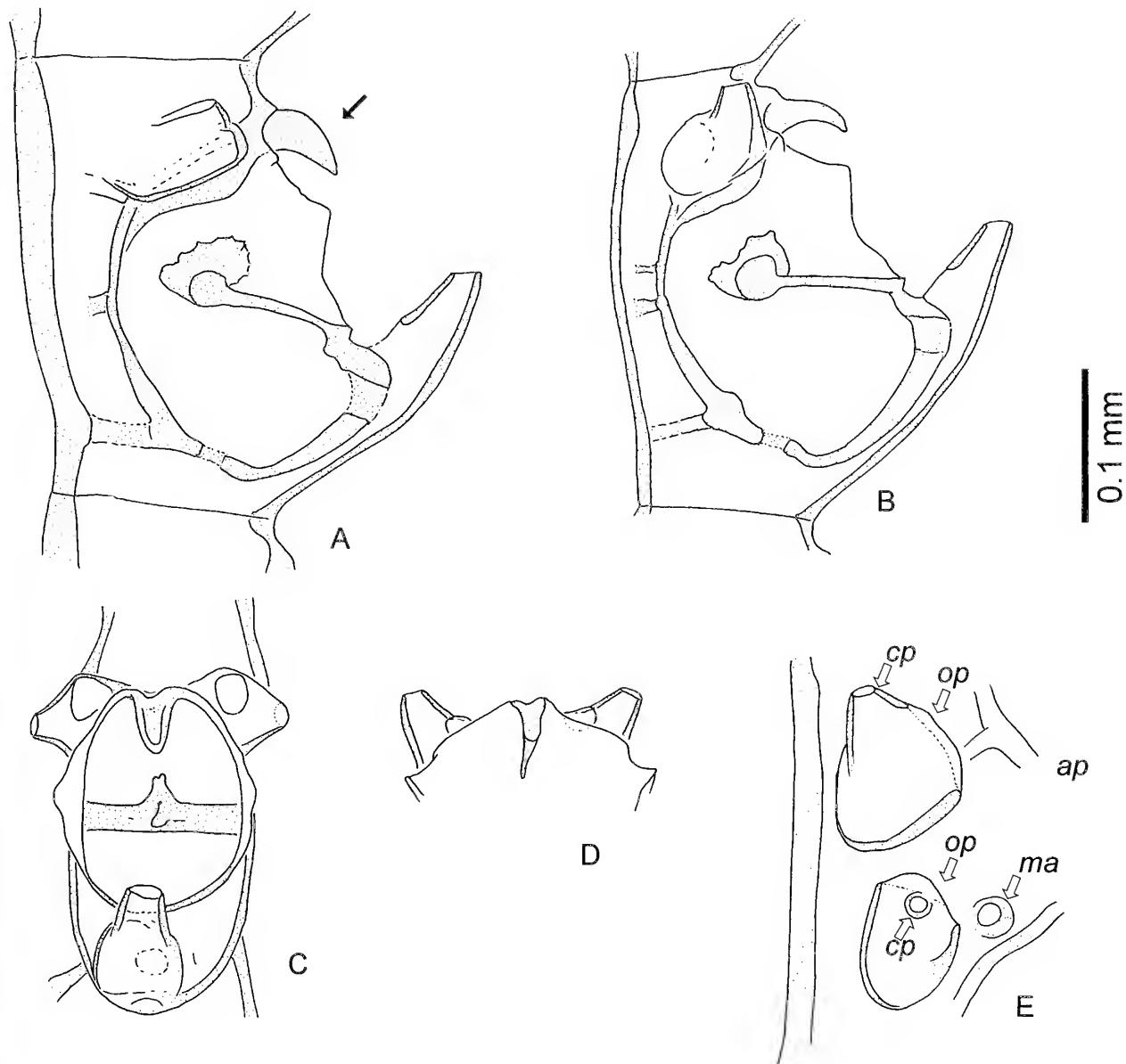


Fig. 35. *Macrorhynchia fulva*, all MHNG-INVE-69649, except B which is MHNG-INVE-87091. (A) Lateral view of hydrotheca of a proximal segment of the hydrocladial. (B) Lateral view of hydrotheca of a distal segment. Besides the shape of the lateral nematothecae, there is not much variation. (C) Hydrotheca in frontal view, proximal segment; the lateral nematothecae point sideways. (D) Hydrothecal opening in frontal view and lateral nematothecae of a distal segment; the lateral nematothecae point more upwards. (E) Main tube of stem with base of apophysis (*ap*) and two nematothecae resembling modified hydrothecae; *cp* = conical protrusion with terminal opening, *op* = opening of theca, *ma* = mamelon. The scale bar applies to all figures.

segments of the hydrocladium they are more or less upright (Fig. 35D). However, even in the type material this seems to be case (comp. fig. 4D in Di Camillo *et al.*, 2009).

***Macrorhynchia crestata* new spec.**

Figs 36A-I, 37

Holotype: MHNG-INVE-69639; Japan, Okinawa Islands, SE of Kume Island, 26.2836°N 126.9007°E, 142-149 m; 13.11.2009, fertile colony.

Paratypes: MHNG-INVE-88807; Japan, Okinawa Islands, SE of Kume Island, 26.2836°N 126.9007°E, 142-149 m; 13.11.2009, fertile colonies, same batch as holotype colony. – MHNG-INVE-69621; Japan, Okinawa Islands, S of Kume Island, 26.2545°N 126.7946°E, 114-115 m; 13.11.2009; fertile colony. – MHNG-INVE-87096; Japan, Okinawa Islands, S of Kume Island, 26.2454°N 126.8175°E, 141-165 m; 20.11.2009; infertile colony. – MHNG-INVE-87097; Japan, Okinawa Islands, SE of Kume Island, 26.2962°N 126.8968°E, 90-91 m; 13.11.2009; infertile colony. – MHNG-INVE-87240; Japan, Okinawa Islands, S of Kume Island, 26.2579°N 126.7871°E, 116-125 m; 20.11.2009; infertile colony.

Diagnosis: Like *M. phoenicea*, but with an adcauline, vertical keel-like intrathecal septum which is larger than in *M. fulva* and not protruding out of the hydrotheca as a tongue-like process. Nematothecae lateral of hydrotheca with opening directed upwards.

Etymology: The specific epithet “*crestata*” refers to the vertical, keel-like intrathecal septum.

Description: Colonies delicate, fan-shaped, multi-pinnate (Fig. 36A), reaching height of 11 cm and width of 5 cm, attached via a root-like hydrorhiza composed of tubular stolons. Stem and major side branches polysiphonic in basal part and thinning out to monosiphonic in distal part, in polysiphonic parts composed of a superficial primary tube bearing hydrocladia and several auxiliary tubes. Auxiliary tubes without nematothecae. Primary tube of side branches originating from auxiliary tubes. Proximal portions of the primary tubes in stem and branches bearing frontal nematothecae only and no hydrocladia, these nematothecae like those in hydrocladia-bearing parts. Primary tube of stem with distinct to indistinct segmentation (nodes), each internode with a hydrocladium on alternate sides. Associated with each hydrocladium on frontal side of primary tubule are two nematothecae, sac-like, with an oval distal opening and a conical nematotheca-like process with a terminal opening (Fig. 36B-C). Near base of hydrocladium a mamelon (short, conical process with distal opening). Hydrocladia alternate, more or less parallel, segmented

by transverse or slightly oblique nodes, up to 10 segments per hydrocladium. Hydrotheca large, bowl-shaped, short free adcauline side, very short or no free abcauline side, one large, thick intrathecal septum on abcauline side, its end curled and thickened with irregular prickles, small adcauline septum above pore for polyp. Near rim of adcauline side a distinct and characteristic keel-like vertical septum (Figs 36D-F, 37). Hydrothecal rim with one broad and a smaller, more adcauline tooth (Fig. 36F), position, size, and shape of teeth rather variable (Fig. 36H). Behind hydrotheca three thick annular ridges. Median inferior nematotheca tubular, tapering, over-topping hydrothecal opening but length variable, one terminal opening and one oval opening on adcauline side where fused to hydrotheca. Lateral nematothecae conical, shape variable, terminal opening directed along axis of hydrocladium, second opening adcauline near base. Gonothecae on modified hydrocladia (phylactocarps) replacing a normal hydrocladium. One gonotheca per phylactocarp, lentil-shaped, in proximal part two wings flanking attachment stalk (Fig. 36I). First segment of phylactocarp a normal hydrothecate segment, followed by an unsegmented tube with initially two rows of long, conical nematothecae, more distally three indistinct rows of nematothecae. Gonotheca attached distal to hydrothecate segment.

Measurements (all type material):

Colony size: height 5-11 cm, width 5 cm

Diameter of main tube: 115-145 µm

Distance of hydrocladia of one side: 0.49-0.81 mm

Length of hydrocladial segments: 0.29-0.35 mm

Hydrotheca opening diameter: 130-180 µm

Height lateral nematotheca: 30-70 µm

Size median inferior nematotheca: 85-170 µm

Length phylactocarp: 1.7 mm

Gonotheca: 0.25 mm

Large microbasic heteroneme: ca 70 µm long

Type locality: Japan, Okinawa Islands, SE of Kume Island, 26.2836°N 126.9007°E, 142-149 m.

Distribution: Okinawa Archipelago, Kume Island.

Remarks: *Macrorhynchia crestata* resembles closely *M. fulva*, particularly in the macroscopic aspect of the colony and the microscopic morphology of the hydrotheca (comp. Figs 35A-B and 36D-E).

Macrorhynchia crestata can be distinguished from *M. fulva* by:

- the clear absence of the tongue-like process protruding on the adcauline side of the hydrothecal rim,
- the larger intrathecal, vertical keel,
- the lateral nematothecae which are always directed along the axis of the segment (Fig. 36G).

The currently known material of both nominal species seems distinct, but it is possible that both nominal species are only variants that become inseparable once more specimens and a more complete knowledge of the

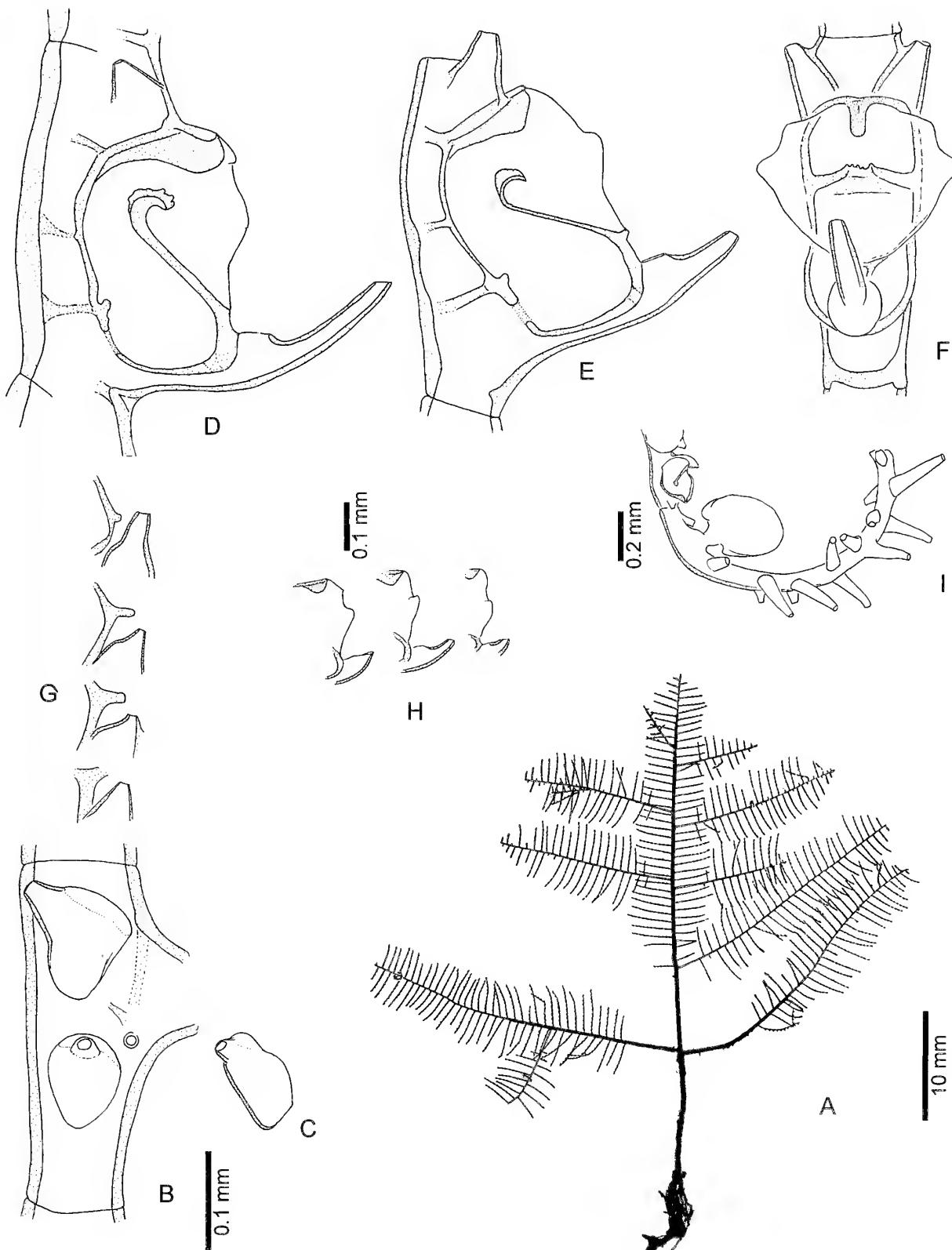


Fig. 36. *Macrorhynchia crestata* n. spec. all MHNG-INVE-69639 (holotype), except H which is from MHNG-INVE-87097. If not otherwise indicated, all magnifications are as in B. (A) Colony silhouette. (B) Segment of main tube of stem, apophysis of cladium directed towards right. Two nematothecae with conical processes are present. The double circle at the base of the apophysis is a mamelon (compare also Fig. 35E). (C) Lateral view of lower nematotheca depicted in B. (D) Lateral view of hydrothecate segment in proximal region of cladium. (E) Lateral view of hydrothecate segment in distal region of cladium. (F) Frontal view of hydrothecate segment. (G) Variation of the lateral nematotheca from proximal (below) to distal (top). (H) Variation of hydrothecal rim within the same colony. (I) Phylactocarp with a single gonotheca.

variation are known. A molecular genetic study is in progress and will hopefully provide additional arguments. In order to facilitate discussion, it is preferable to have a name for this form.

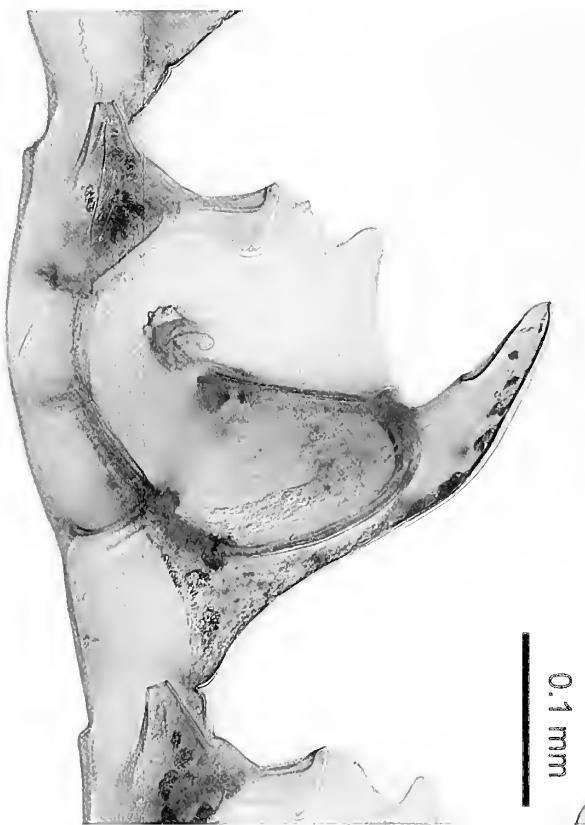


Fig. 37. *Macrorhynchia crestata* n. spec. MHNG-INVE-69639 (holotype), photograph of lateral view of hydrotheca (focus stacking image).

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***Charaea luzonicum* sp. nov. (Coleoptera: Chrysomelidae: Galerucinae): the first record of *Charaea* in the Philippines**

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Abstract: The first representative of the genus *Charaea* Baly, 1878, *Ch. luzonicum* sp. nov., is described from Luzon Island, the Philippines. Based on the characteristic internal sclerites of the aedeagus, the new species belongs to the *Ch. coomani* species group. Colour photos and drawings of habitus and both male and female genitalia are presented.

Keywords: Coleoptera - Chrysomelidae - Galerucinae - taxonomy - new species - Luzon

INTRODUCTION

The taxonomy and geographic distribution of the genus *Charaea* are insufficiently known. The main reason is a long and complicated history of taxonomic research of the genus *Charaea* (see Bezděk & Lee, 2014). The species were dispersed in various genera (predominantly in *Calomicrus* Dillwyn, 1829 and *Exosoma* Jacoby, 1903) and cummulated to *Charaea* just in several last years (Beenen & Warchałowski, 2010; Bezděk, 2012; Bezděk & Lee, 2014). *Taphinellina* Maulik, 1936, usually treated as synonym of *Charaea*, is not congeneric and its taxonomic position will be clarified in the near future (Bezděk, submitted). Recently, *Charaea* was synonymized either with *Calomicrus* or *Exosoma* (see Medvedev & Sprecher-Uebersax, 1998; Kimoto, 2004) but these acts were unwarranted and not followed by subsequent authors as *Calomicrus* and *Exosoma* are morphologically and partly also geographically remarkably different. Last year, the genus *Charaea* was redescribed, clarified as valid genus and compared with similar genera (Bezděk & Lee, 2014).

Currently, 44 speeies distributed in the eastern Palaearctic, Himalayas, China and adjacent countries of the Oriental Region are classified in *Charaea*. However, some transfers from other genera are still expected and at least 20 new speeies are waiting for being described. During a two weeks stay in Naturhistoriska Riksmuseet Stockholm within the frame of Synthesys (SE-TAF-3534), I examined several tens of species originating from the Philippines and named by the German coleopterist Julius Weise (1844-1925) but never described, including those provided with the unpublished manuscript name

Calomicrus luzonicus. The specimens belong to *Charaea* and represent the first known *Charaea* specimens from the Philippines. Although the distribution of the genus *Charaea* was significantly extended last year, the discovery of the new species in the Philippines is really surprising and suggests a much wider distribution than expected as there is so far no confirmed occurence of the genus *Charaea* in the Sunda islands of Malaysia and Indonesia.

MATERIAL AND METHODS

All measurements were made using an ocular grid mounted on MBS-10 stereomicroscope (at 16× magnification for the body length and 32× magnification for the remaining measurements). Photographs of specimens were taken with Canon EOS 550D digital camera with Canon MP-E 65 mm objective. Images of the same objects at different focal planes were combined using Helicon Focus 5.1.3 software.

The aedeagus was soaked overnight in cold 10% KOH solution, washed in water and an entomological pin was moved through the basal orifice to push the internal sac through the dorsal opening. The aedeagus with everted sac was put into a depression slide filled with glycerol, covered by a cover slip and photographed. The aedeagus was then put into a microvial with glycerol attached to the pin with the specimen. Subsequently, the figures were edited with Corel Photopaint 12.

TAXONOMY

Genus *Charaea* Baly, 1878

Charaea Baly, 1878: 376 (type species *Charaea flaviventre* Baly, 1878, by monotypy).

Taphinellina Maulik, 1936: 299 (type species *Taphinella bengalensis* Jacoby, 1900, by original designation).

Charaea luzonicum Bezděk sp. nov.

Figs 1-10

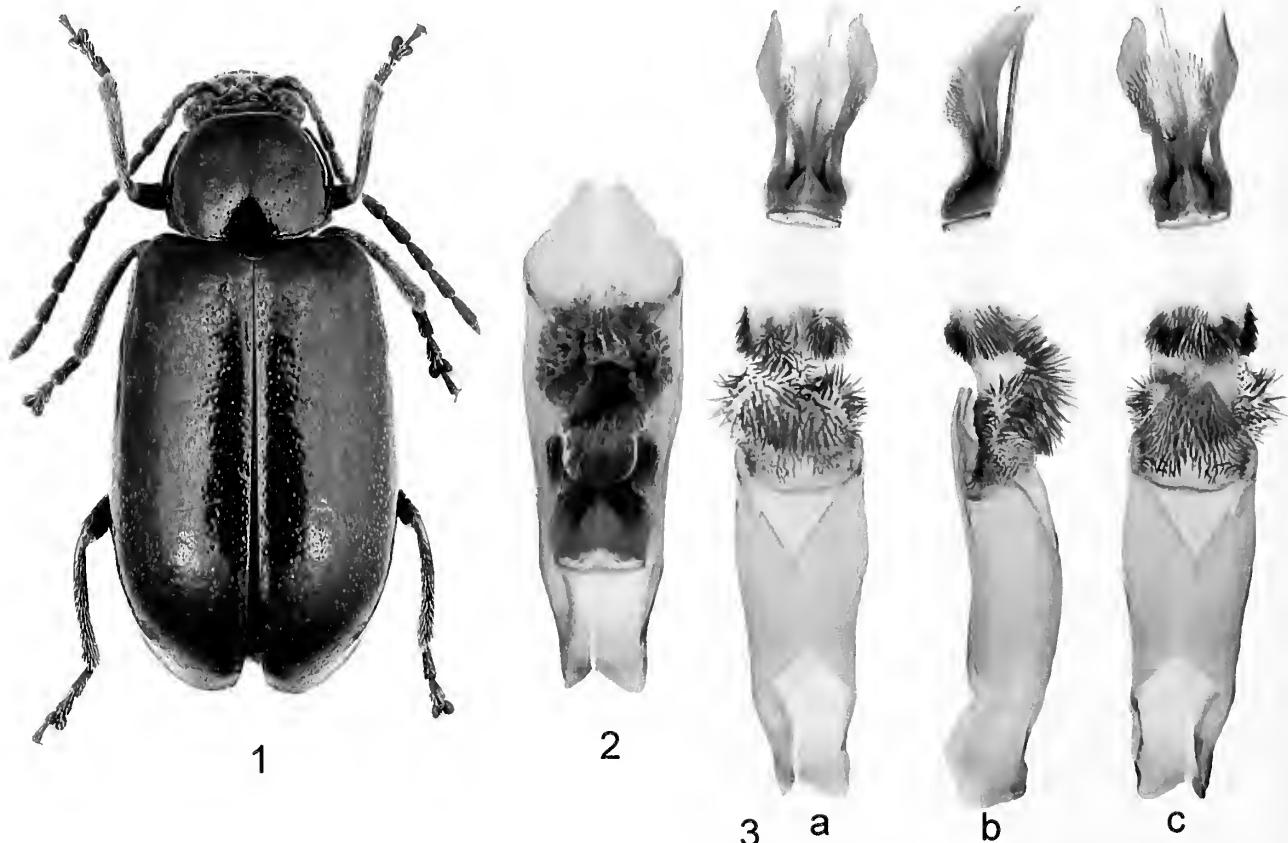
Holotype: NHRS-JLKB 000023081; male; Mt. Banahao; P. I. Baker leg.

Paratypes: NHRS-JLKB 000023079; male; Mt. Banahao; P. I. Baker leg. – NHRS-JLKB 000023082; female; Mt. Banahao; P. I. Baker leg. – NHRS-JLKB 000023080; female; Mt. Banahao; P. I. Baker leg. – NHRS-JLKB 000023083; female; Mt. Banahao; P. I. Baker leg. – NHRS-JLKB 000023085; Baguio, Benguet; P. I. Baker leg.

The specimens are provided with one additional red label: HOLOTYPE, [or PARATYPE], *Charaea luzonicum* sp. nov., J. Bezděk det., 2014. All the specimens are deposited in Naturhistoriska Riksmuseet Stockholm (Sweden).

Diagnosis: Due to a diagnostic structure of the aedeagus and particularly the internal sac with long clavate lateral sclerites, *Charaea luzonicum* sp. nov. belongs to the *Ch. coomani* group as tentatively defined by Bezděk & Lee (2014). Currently, the group contains 4 species: *Ch. coomani* (Gressitt & Kimoto, 1963) (Vietnam), *Ch. hainanicum* (Gressitt & Kimoto, 1963) (China: Hainan), *Ch. mimicum* (Medvedev, 1998) (Taiwan) and *Ch. kelloggi* (Gressitt & Kimoto, 1963) (Taiwan, Hongkong, China: Fujian, Guizhou, Guangdong).

A male of *Ch. hainanicum* was not available for this study, but the apex of its aedeagus is widely obtusangulate (Fig. 12) based on the drawing in the original description, while it is concave in *Ch. luzonicum* sp. nov. (Fig. 10). From the other three species, *Charaea luzonicum* sp. nov. can be distinguished by wider pro- and mesotarsomeres I (other species in *Ch. coomani* group have also parallel pro- and mesotarsomeres I but slenderer), shorter subapical antennomeres (2.2 times as long as wide in *Ch. luzonicum* sp. nov. while 2.5 times in *Ch. kelloggi* and 3 times in *Ch. coomani* and *Ch. mimicum*), an aedeagus not prolonged apically and its ventral side with shallow median impression (aedeagus with more or less prolonged apex and without impression in *Ch. kelloggi*, *Ch. coomani* and *Ch. mimicum*) (cf. Figs 10-14), the outer sides of lateral sclerites in aedeagus with fine



Figs 1-3. *Charaea luzonicum* sp. nov. (1) Habitus (male, holotype, 5.2 mm). (2) Transmitted light illumination of aedeagus in dorsal view, internal sac not everted. (3) Aedeagus with everted internal sac (a - dorsal, b - lateral, c - ventral view). Not to scale.

denticulations (Fig. 7; smooth in *Ch. kelloggi* and *Ch. mimicum*, not studied in *Ch. coomani*).

Etymology: Derived from Luzon Island where the type series was collected.

Description: Dorsal side glabrous, oval, eonvex. Colour metallic bluish-black, abdomen yellowish brown, mandibles brown with black apices, labrum metallic with brownish anterior margins, antennae black with antennomeres I-III brownish, legs metallic with brownish knees.

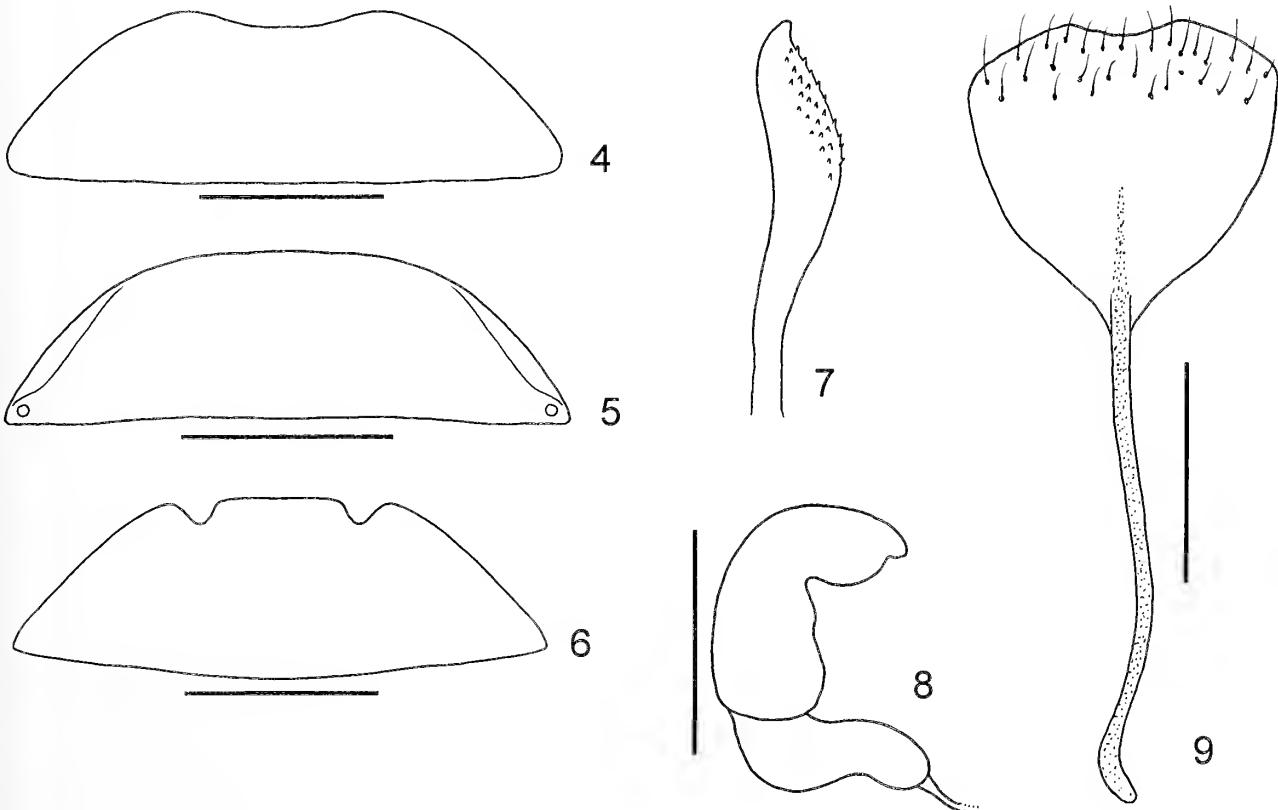
Male (holotype, Fig. 1). Labrum transverse, with six pores in transverse row bearing pale seta, with rounded and convergent lateral margins, anterior margin emarginate in middle. Anterior part of head nearly impunctate, lustrous, with several long setae on anterior margin of clypeus, along lateral margins of nasal keel and along anterior margins of antennal sockets. Nasal keel wide, moderately convex. Interantennal space 1.8 times as wide as transverse diameter of antennal socket. Frontal tubercles large, subtriangular, elevated, lustrous, glabrous, impunctate, anterior tips divergent, separated by nasal keel. Interocular space wide, 2.2 times as wide as transverse diameter of eye. Vertex separated from frontal tubercles by deep furrow, impunctate, behind each eye with several long setae. Antennae filiform,

0.55 times as long as body, length ratio of antennomeres equals 12-5-6-10-10-10-10-11-11-15, antennomeres I-III lustrous, covered with sparse setae, antennomeres IV-XI dull, covered with dense short setae.

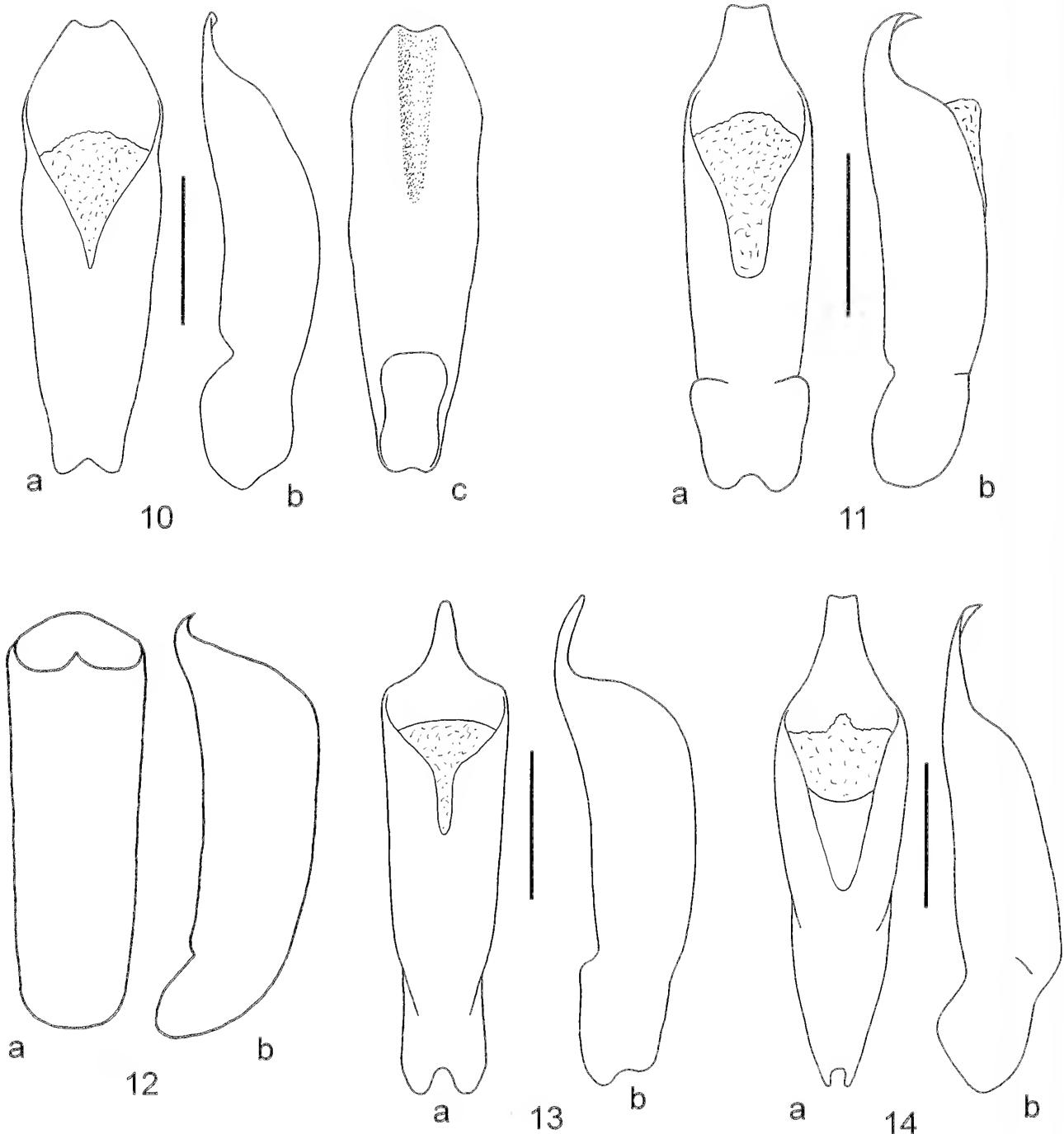
Pronotum lustrous, 1.3 times as broad as long, widest in middle, moderately convex, covered with double punctures (smaller and larger). Anterior margin nearly straight, unbordered, lateral margins rounded with broad border, posterior margin straight in middle, lateral parts rounded, thinly bordered. Anterior angles distinctly swollen, rectangular, posterior angles with small pointed tip. All angles with setigerous pore bearing long pale seta, additional short setae visible on lateral margins of pronotum.

Scutellum subtriangular with widely rounded tip, impunctate, glabrous.

Elytra 1.6 times as long as wide and 0.6 times as long as body, widest behind middle, almost glabrous (with very scarce short pale setae on apical slopes), densely covered with fine small confused punctures. Humeral calli well developed. Epipleura impunctate, wide basaly, gradually narrowing and disappearing before apex. Macropterous. Anterior coxal cavities opened posteriorly. Prosternal process thinly visible but not elevated between procoxae. Ventral surface lustrous, sparsely covered with fine punctures and pale setae, metepisterna dull, covered



Figs 4-9. *Charaea luzonicum* sp. nov. (4) Female last ventrite. (5) Female pygidium. (6) Male last ventrite. (7) Right lateral sclerite in aedeagus. (8) Spermatheca. (9) Sternite VIII. Scale bars: 0.5 mm for Figs 4-6, 0.25 mm for Figs 8-9.



Figs 10-14. Aedeagus (a - dorsal, b - lateral, c - ventral view). (10) *Charaea luzonicum* sp. nov. (11) *Ch. coomani*. (12) *Ch. hainanicum* (based on Gressitt & Kimoto, 1963). (13) *Ch. kelloggi*. (14) *Ch. mimicum*. Scale bar: 0.5 mm.

with dense setae. Abdomen with last ventrite transverse, posterior margin with two short subtriangular incisions, median lobe slightly concave (Fig. 6).

Legs slender. All tibiae with apical spur in both sexes. Length ratio of protarsomeres I, II, III and V equals 9-6-5-11, protarsomere I robust, parallel, 1.8 time as long as wide; length ratio of mesotarsomeres I, II, III and V equals 11-9-5-12, mesotarsomere I robust, subparallel, with lateral margins shallowly widely concave, 2.2 time as

long as wide; length ratio of metatarsomeres I, II, III and V equals 12-8-5-12, metatarsomere I elongate triangular, 2.4 times as long as wide. Claws appendiculate. Aedeagus symmetrical, subtubular, parallel subapically, basal half slightly convergent, apical part convergent with tip concave, ventral side with shallow furrow in apical half (Figs 2, 10). Internal sac with three sclerites: very slender median sclerite and pair of lateral sclerites which are flat, subclavate, with outer lateral side covered

with fine denticulations. Median sclerite is slightly longer than lateral ones (Figs 3, 7).

Female: Interocular space slightly wider, 2.55 time as wide as transverse diameter of eye. Protarsomere I and mesotarsomere I not parallel but elongate triangular. Last ventrite transverse with posterior margin widely shallowly concave (Fig. 4). Pygidium transverse, widely rounded (Fig. 5). Sternite VIII (Fig. 9) subtriangular with anterior margin shallowly concave in middle, laterally oblique, lateral margins slightly rounded towards tignum, short setae are cummulated along posterior margin, tignum slender, twice longer than sternite VIII, apically bent. Spermatheca: nodulus poorly delimited, elongate, slightly wider than cornu, cornu shortly C-shaped with inner angle sharp, apex with indicated appendix, proximal spermathecal duct robust, slightly S-shaped (Fig. 8).

Dimensions: Males: 4.3-5.3 mm (holotype 5.3 mm), females: 4.7-5.3 mm.

Distribution: Philippines (Luzon Isl.).

Type locality: Philippines, Luzon, Banahao Mt. [14°03'53"N 121°28'47"E].

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A second species of *Smetanabatrus* (Coleoptera: Staphylinidae: Pselaphinae)

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Abstract: *Smetanabatrus ghecu* sp. n. from Myanmar is described, illustrated, and compared to its only congener *S. kinabalu* Yin & Li, 2013 in Borneo. Male secondary sexual modifications of the new species are much less developed than in males of *S. kinabalu*, in addition to genitalic differences.

Keywords: Taxonomy - Asian biodiversity - new species - morphology - Myanmar.

INTRODUCTION

The monotypic genus *Smetanabatrus* Yin & Li currently contains a single species, *S. kinabalu* Yin & Li, from Sabah, northern Borneo (Yin & Li, 2013). During the course of a study on the Pselaphinae material from the Museo Civico di Storia Naturale “Giacomo Doria”, Genova (MSNG), we discovered a new species of *Smetanabatrus* collected in central Myanmar by Leonardo Fea during 1888. Unlike *S. kinabalu* which has strongly modified legs and abdomen in adult males, the new species appears much more ‘simple’ in possessing male characters only on the protibiae, venter of the head, and sternite V. Based on study of this second species, it seems that the expanded maxillary palpomeres IV and the broadly transverse aedeagal basal bulb may be considered as possible synapomorphies since they are shared by both species. With a large geographical span between the type localities of *S. kinabalu* and the new species, additional members of *Smetanabatrus* are expected to be found in Southeast Asia.

MATERIAL AND METHODS

The type series of the new species described below is deposited in MSNG (Roberto Poggi).

The label data are quoted verbatim. A slash is used to separate different labels. Authors' supplementary notes are included in square brackets. The following abbreviations are applied: AL—length of the abdomen along the midline; AW—maximum width of the abdomen; EL—length of the elytra along the sutural line; EW—maximum width of the elytra; HL—length of the

head from the anterior clypeal margin to the occipital constriction; HW—width of the head across eyes; PL—length of the pronotum along the midline; PW—maximum width of the pronotum. Length of the body is a combination of HL + PL + EL + AL.

TAXONOMIC PART

Smetanabatrus ghecu, new species

Figs 1-2

Type locality: Central Myanmar, southern Shan State, Carin Asciuii Ghecu.

Type material (3 ♂♂, 16 ♀♀): Holotype [MSNG]: MYANMAR: ♂, labeled ‘Carin Asciuii Ghecu [approximate coordinate: 19°41'N, 97°00'E, (Schillhammer, pers. comm.)], 1400-1500 m, L. Fea. III-IV. [18]88. / Museo Civico di Genova’. Paratypes [MSNG]: MYANMAR: 2 ♂♂, 14 ♀♀, same data as holotype; 2 females, same data, except ‘1300-1400 m’.

Diagnosis: Body large-sized, average length 3.3 mm. Head and pronotum coarsely granulate, vertex with a distinct median carina, pronotum with discal carinae and distinct median and lateral sulci; maxillary palpi IV greatly broadened; tergite IV largest, about four times as long as tergite V. Male with large ocular canthi, and abdominal sternite V possessing a trapezoidal protuberance at middle. Tergite VII of female shorter than that of male, and posterior margin at middle more emarginate than in male; genital complex weakly sclerotized, transverse.

Description: Male (Fig. 1A). BL 3.29-3.31 mm. Body reddish brown, tarsi lighter in color; most part of dorsal surface densely setose. Head distinctly transverse, HL 0.63-0.69 mm, HW 0.77-0.82 mm; surface coarsely granulate; vertex slightly convex, foveae below level of posterior margins of eyes, with reverse U-shaped sulcus connecting foveae, median carina present from base toward apex of frons; eyes relatively large, each

composed of about 55 facets; with large ocular canthi (Fig. 2A); maxillary palpi (Fig. 2E) with greatly broadened palpomeres IV; antennomeres each elongate, clubs indistinct (Fig. 1A). Pronotum nearly cordiform, wider than long, PL 0.69-0.71 mm, PW 0.74-0.78 mm, coarsely granulate; with large antebasal spines, with deep median sulcus, thin, curved discal carinae, and sinuate lateral sulci; lateral margins rounded, gradually



Fig 1. Dorsal habitus of *Smetanabatrus ghecu* sp. n. (A) Male. (B) Female. Scales: 1.0 mm.

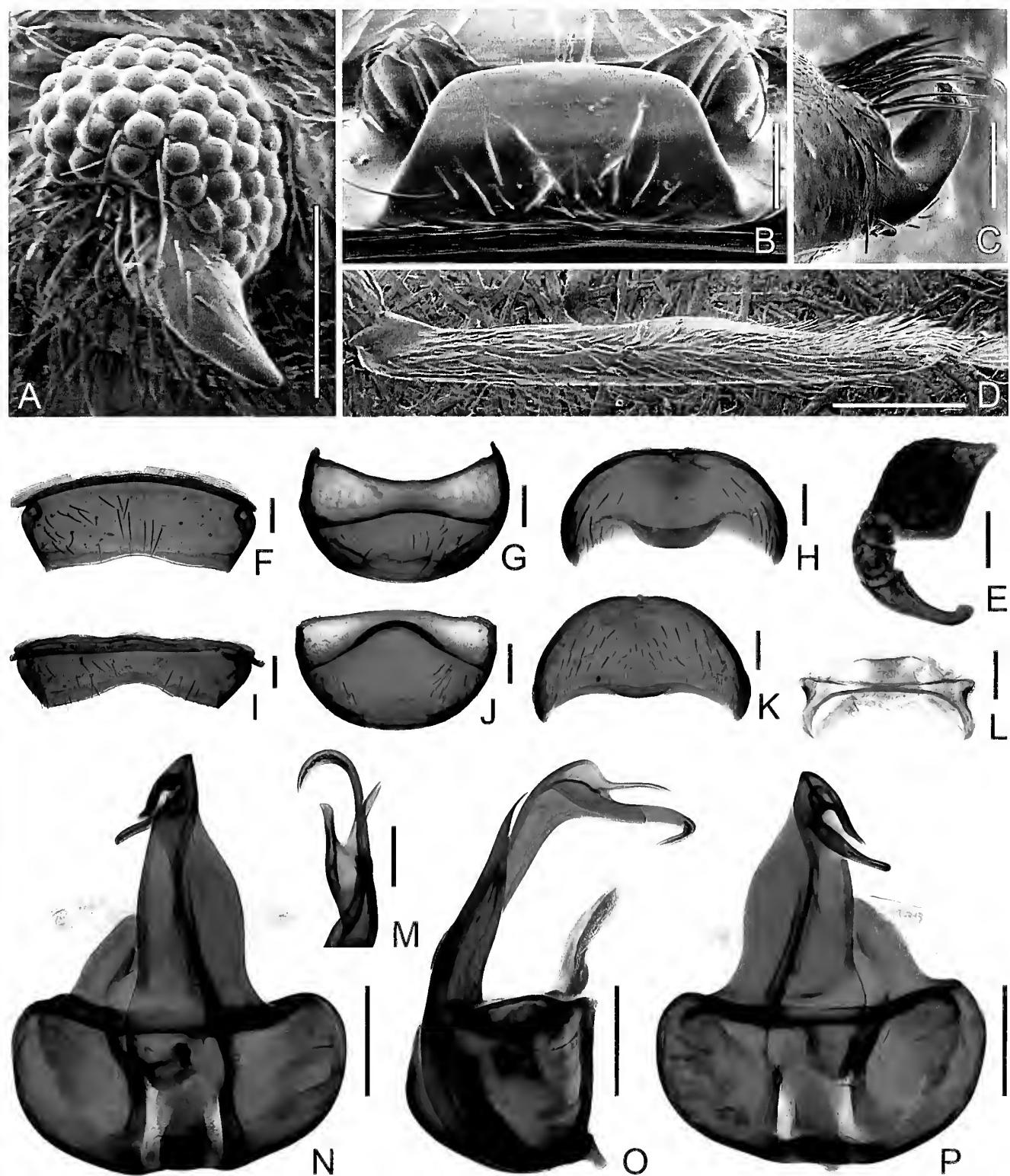


Fig 2. Diagnostic characters of *Smetanabatrus ghecu* sp. n. (A-D, E-H, M-P Male. I-L Female). (A) Compound eye and ocular canthus. (B) Protuberance of sternite V, in ventral view. (C) Same, in lateral view. (D) Protibia. (E) Maxillary palpus. (F, I) tergite VII. (G, J) tergite VIII. (H, K) sternite VIII. (L) Genital complex. (M) Apex of aedeagal ventral lobe, in axial view. (N) Aedeagus, in dorsal view. (O) Same, in lateral view. (P) Same, in ventral view. Scales: A, D, N-P = 0.2 mm; E-L = 0.1 mm; B, C, M = 0.05 mm.

narrowed from middle toward base. Elytra slightly wider than long, EL 1.03-1.05 mm, EW 1.17-1.20 mm; surface finely punctate; with three large, deep basal foveae. All legs simple, except protibiae (Figs 1A, 2D) slightly expanded at mesal margins near middle. Abdomen slightly wider than long, AL 0.88-0.92 mm, AW 1.10-1.12 mm; tergite IV largest, simple, about four times as long as tergite V, tergites VI-VII successively shorter, tergite VII (Fig. 2F) shallowly emarginate at middle of posterior margin, tergite VIII (Fig. 2G) semicircle; sternite V with trapezoidal protuberance at middle (Fig. 2B, C), sternite VIII (Fig. 2H) transverse. Aedeagus (Fig. 2N-P) asymmetric, length 0.37 mm; transverse basal bulb with large foramen; ventral lobe elongate, broad at base, apex split to three thin sclerites (Fig. 2M); ventral membrane transverse, lamellate.

Female (Fig. 1B). Similar to male with the exception of the following: antennae shorter (Fig. 1B), lacking ocular canthi; protibiae straight at mesal margins; sternite V lacking protuberance; each eye composed of about 45 facets. Tergite VII (Fig. 2I) with posterior margin more emarginate at middle than in male; tergite VIII (Fig. 2J) semicircular, sternite VIII (Fig. 2K) transverse. Genital complex (Fig. 2L) 0.36 mm wide, transverse, lacking lateral sclerites. Measurements: BL 3.29-3.32 mm, HL 0.67-0.68 mm, HW 0.78-0.79 mm, PL 0.69-0.71 mm, PW 0.74-0.76 mm, EL 1.02-1.03 mm, EW 1.18-1.20 mm, AL 0.88-0.93 mm, AW 1.07-1.08 mm.

Comparative notes: Both sexes of the new species can be separated from members of its congener, *S. kinabalu*, by the coarsely granulate dorsal surfaces of the head and pronotum, the median carina of the head and median sulcus of the pronotum are more distinct, the maxillary palpomeres IV are more robust, the tergite IV

is relatively much longer, and the structures of the male and female genitalia are distinctly different. The males of *Smetanabatus ghecu* have unmodified profemora, metatibiae, and abdominal tergites (Fig. 1A), while those of *S. kinabalu* have the profemora greatly spinose at ventral margins, the metatibiae angularly expanded at basal third of the lateral margins, and possess dramatically modified abdominal tergites IV-VII (Yin & Li, 2013: figs 1-2).

Distribution: Myanmar: southern Shan State.

Etymology: The specific name is taken from the type locality, Carin Asciuii Ghecù.

ACKNOWLEDGMENTS

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REFERENCE

- Yin Z.-W., Li L.-Z. 2013. *Smetanabatus kinabalu* (Staphylinidae: Pselaphinae: Batrisitae), a new genus and new species from Sabah, Borneo. *Zootaxa* 3718: 477-482.

**Notes on the spider genus *Oedothorax* Bertkau, 1883
with description of eleven new species from India (Linyphiidae: Erigoninae)**

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Abstract: Eleven new species of *Oedothorax* Bertkau in Förster & Bertkau, 1883, are described from several parts of India: West Bengal (Himalayas): *Oedothorax cornutus* sp. nov. (♂ & ♀), *O. falciferoides* sp. nov. (♂), *O. lopchu* sp. nov. (♂) and *O. villosus* sp. nov. (♂ & ♀); Meghalaya: *O. meghalaya* sp. nov. (♂) and *O. uncus* sp. nov. (♂ & ♀); Madras (currently Tamil Nadu): *O. cunur* sp. nov. (♂ & ♀), *O. kodaikanal* sp. nov. (♂ & ♀), *O. paracymbialis* sp. nov. (♂) and *O. rusticus* sp. nov. (♂ & ♀); Kerala: *O. stylus* sp. nov. (♂ & ♀). Based on the new finds, the *Oedothorax* fauna of the Himalayas is known to comprise no less than 27 species, and is thus richer than the remaining Palearctic (22 species). This shows that the Himalayas represent a significant centre of *Oedothorax* speciation, its species apparently being most closely related to those of the Oriental realm. It is the Himalayas that seem to have supplied faunal elements to the Oriental region.

Keywords: Arachnida - Araneae - Himalayas - West Bengal - Madras - Kerala.

INTRODUCTION

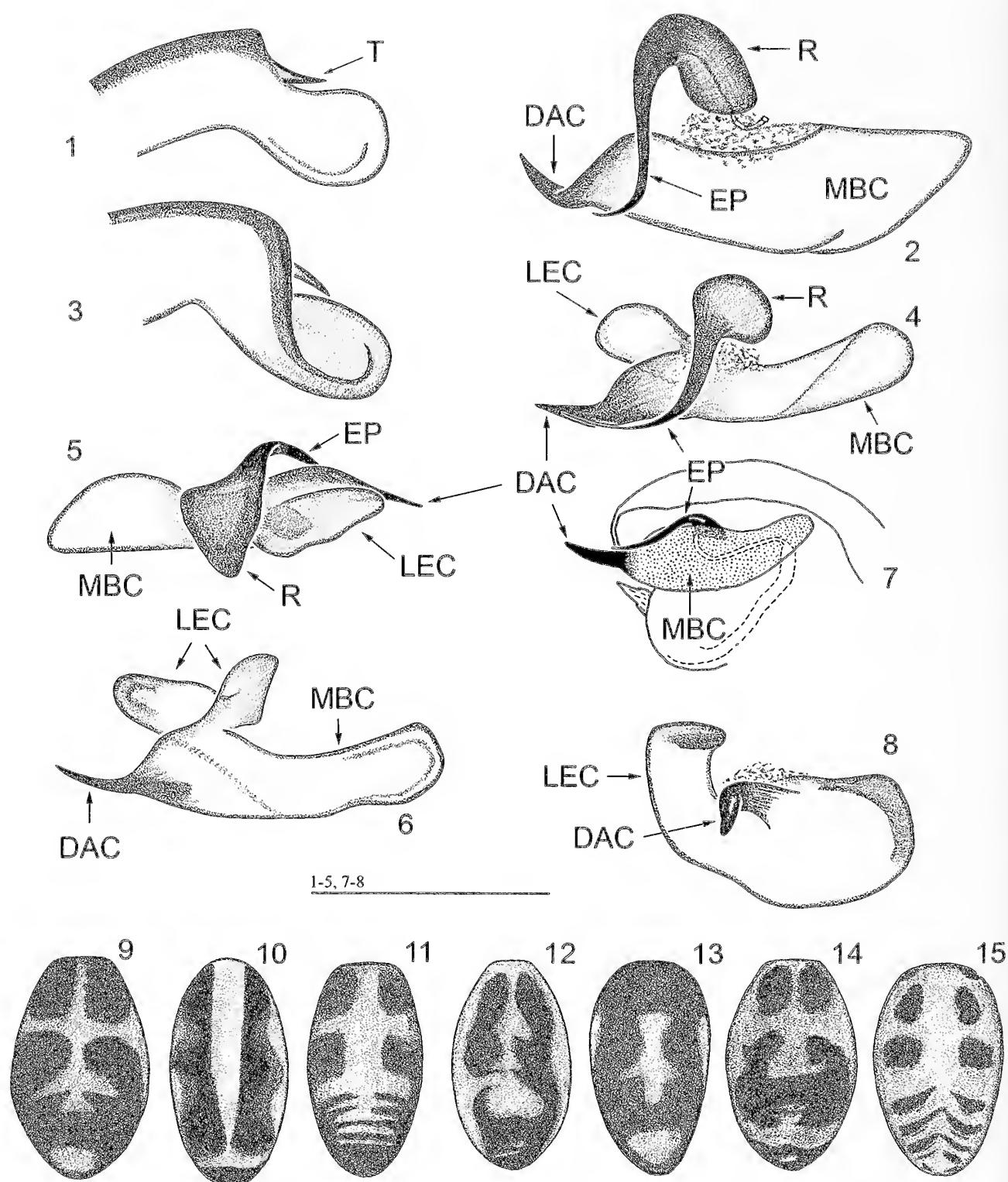
The genus *Oedothorax* is a rather large genus which contains 61 species (World Spider Catalog, 2015). However, when ignoring of the dubious species, including some described from females alone, this diversity is reduced by about one-third.

The genus is characterized by the same formula of chaetotaxy (2.2.1.1), the presence of a trichobothrium on metatarsus IV, and the position of the trichobothrium in the distal half of metatarsus I. Usually the males can easily be distinguished by a modified carapace and by the shape of the palpal tibia, both often highly peculiar. In contrast, the genital organs in many species are very similar even in congeners from different zoogeographical realms (Fig. 2 cf. Fig. 7). In males, the distal suprategular apophysis is not modified and it is characterized by the presence of a pointed tooth ("T" in Fig. 1) in the middle. The embolic division in all congeners consists of two sclerites: embolus and convector [the latter term after Tanasevitch (1998), or "lamella" after Merrett (1963)]. The embolus usually has a small radix and a curved, relatively short embolus proper. In length the latter normally fails to exceed the convector, the shape of which is quite varied, often also species-specific (see Tanasevitch, 2014a, b). As a rule, the convector, or rather its main body ("MBC" in Figs 2, 4-7), is elongated in longitudinal direction and shows a distal apophysis varying in shape ("DAC" in Figs 2, 4-8).

This apophysis is usually dark to black, sclerotized, often pointed. Some species, especially the numerous ones from the Himalayas, have a peculiar lateral extension on the convector ("LEC" in Figs 4-6, 8). In most cases embolus and convector are connected to each other by a translucent membranous tissue. Sometimes this tissue shows varying degrees of sclerotization, then giving both sclerites the appearance of a single sclerite. The duct leading from the distal suprategular apophysis runs inside the embolus bypassing the convector.

The epigynes are very simple and, like the embolic division in the males, are very similar to each other. They are composed of a median plate (= ventral plate *auct.*), the lateral borders of which are not always clear, and of spherical or elongated receptacles which are translucent on both sides of the plate.

This paper presents descriptions of 11 new species of *Oedothorax* from different parts of India: Four species are from the Himalayas (West Bengal), two species are from a small mountain massif situated close to the foot of the Himalayas, in Meghalaya. Five species are reported from southern India: Madras (currently Tamil Nadu) and Kerala. All of the new species are montane, occurring at 900-2600 m a.s.l., and like other Himalayan and Oriental *Oedothorax* species differ from the Palearctic congeners by the presence of a well-expressed dorsal abdominal pattern in both sexes (Figs 9-15).



Figs 1-15. Male palp details (1-8) and abdominal patterns in dorsal view (9-15) in *Oedothorax* spp. (1, 3) Distal suprategular apophysis. (2, 4, 5, 7) Embolic division, different views. (6, 8) Convector, lateral and frontal views, respectively. (1-2) *O. gibbosus* (Blackwall, 1841), type species, specimen from Moscow, Russia. (3-6) *O. meridionalis* Tanasevitch, 1987, specimen from Naryn, Tian-Shan Mts, Kyrgyzstan. (7) *O. nazareti* Scharff, 1989, Shoa Prov., Ethiopia, after Scharff (1989). (8) *O. rusticus* sp. nov. (9) *O. savigniformis* Tanasevitch, 1998. (10) *O. assuetus* Tanasevitch, 1998. (11) *O. sexoculorum* Tanasevitch, 1998. (12) *O. clypellum* Tanasevitch, 1998. (13) *O. simplicithorax* Tanasevitch, 1998. (14) *O. falcifer* Tanasevitch, 1998. (15) *O. coronatus* Tanasevitch, 1998, all from Nepal, after Tanasevitch (1998). Figures 6, 9-15 not to scale.

MATERIAL AND METHODS

This paper is based on material from India that is kept at the Muséum d'histoire naturelle de Genève, Switzerland (MHNG). If not mentioned otherwise, the material examined is deposited in the MHNG; some paratypes are placed in the collection of the Zoological Museum of the Moscow State University, Moscow, Russia (ZMMU). Sample numbers are given in square brackets.

The terminology of copulatory organs mainly follows that of Tanasevitch (1998, 2014a, b) and Hormiga (2000). The chaetotaxy of Erigoninae is given in a formula, e.g., 2.2.1.1, which refers to the number of dorsal spines on tibiae I-IV. As far as possible, paratypes were used for descriptions and measurements to avoid damage of body, legs, setae, etc. in the holotypes. The sequence of leg segment measurements is as follows: femur + patella + tibia + metatarsus + tarsus. All measurements are given in mm. Scale lines in the figures correspond to 0.1 mm unless indicated otherwise. Figure numbers are given above the scale lines, the alternative distance below.

Specimens preserved in 70% ethanol were studied using a MBS-9 stereomicroscope and a Wild compound microscope. A Levenhuk C-800 digital camera was used for some drawings. Images of multiple focal sections were combined using Helieon Focus image stacking software, version 5.1.

Abbreviations

The following abbreviations are used in the text and figures:

a.s.l.	Above sea level
D	Duct
DAC	Distal apophysis of convector
DSA	Distal suprategular apophysis
E	Embolus
EP	Embolus proper
Fe	Femur
LEC	Lateral extension of convector
MBC	Main body of convector
MNHG	Muséum d'histoire naturelle de Genève
Mt	Metatarsus
P	Paraeymbium
R	Radix
Re	Receptacle
T	Tooth on DSA
Ti	Tibia
TmI	Position of trichobothrium on metatarsus I

TAXONOMIC PART

Oedothorax cornutus sp. nov.

Figs 16-25

Holotype: Male; INDIA, Himalayas, West Bengal, Darjeeling Distr., Tigerhill, 2500-2600 m a.s.l., near top, sifting in forest; 18.X.1978; leg. C. Besuchet & I. Löbl [#19].

Paratype: 1 female, collected together with the holotype.

Diagnosis: The new species can be easily distinguished from other congeners by the peculiar shape of the male carapace, which bears a pair of thick, short, appressed horn-like setae, as well as by the presence of a rounded postocular elevation on the carapace, separated from the head part by a deep slit.

Etymology: The specific name is a Latin adjective, meaning "horned", referring the presence of a pair horn-like setae on a head of the male carapace.

Description: Male (holotype). Total length 1.95. Carapace 0.90 long, 0.70 wide, pale brown. Cephalic part of carapace bearing a pair of thick, short, appressed to a head horn-like setae; a pale, yellow, rounded, postocular elevation being separated from cephalic part by a deep slit (Figs 16-18). Chelicerae 0.35 long, unmodified. Legs pale brown, almost yellow. Leg I 2.78 long (0.75+0.23+0.70+0.65+0.45), IV 2.91 long (0.85+0.20+0.73+0.75+0.38). Chaetotaxy: spines mostly lost, should be 2.2.1.1. TmI 0.87. All metatarsi with a trichobothrium. Palp (Figs 19-24): Tibia with a strong claw-shaped apophysis apically, at right angle to axis of segment. Paracymbium relatively small, hook-shaped. Distal suprategular apophysis flat, truncated apically, with a small, sharp tooth in middle. Embolus small, bent at 90°, its radical part slightly expanded. Convector elongated, narrow, almost straight, with a flat, narrow, flag-shaped lateral extension distally. Abdomen 1.13 long, 0.68 wide, dorsally pale, with a pair of grey spots in anterior part and with a herringbone pattern posteriorly.

Female. Total length 2.03. Carapace 0.93 long, 0.65 wide, pale brown, unmodified. Chelicerae 0.38 long, unmodified. Legs yellow. Leg I 2.94 long (0.83+0.25+0.73+0.68+0.45), IV 3.09 long (0.83+0.25+0.75+0.83+0.43). Chaetotaxy 2.2.1.1, length of spines 1.5-2 times diameter of segment long. All metatarsi with a trichobothrium. TmI 0.82. Abdomen 1.13 long, 0.80 wide, dorsally pale, with two pairs of grey paramedian spots in anterior part, and with three pairs of short narrow transversal stripes posteriorly. Epigyne as in Fig. 25: median plate with inclined lateral sides, receptacles spherical.

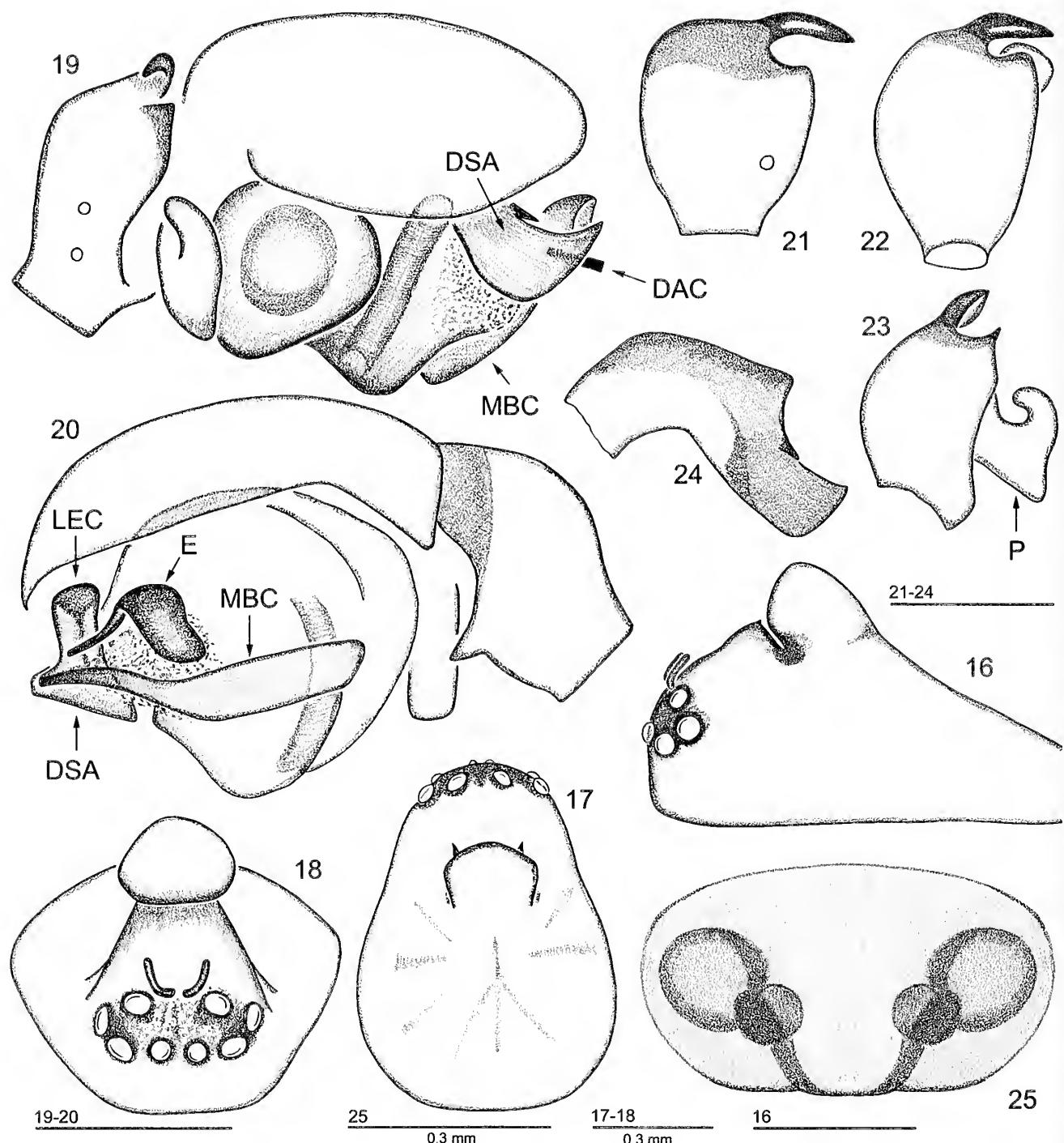
Taxonomic remarks: The new species is similar to *O. villosus* sp. nov. (see below).

Distribution: Only known from the type locality.

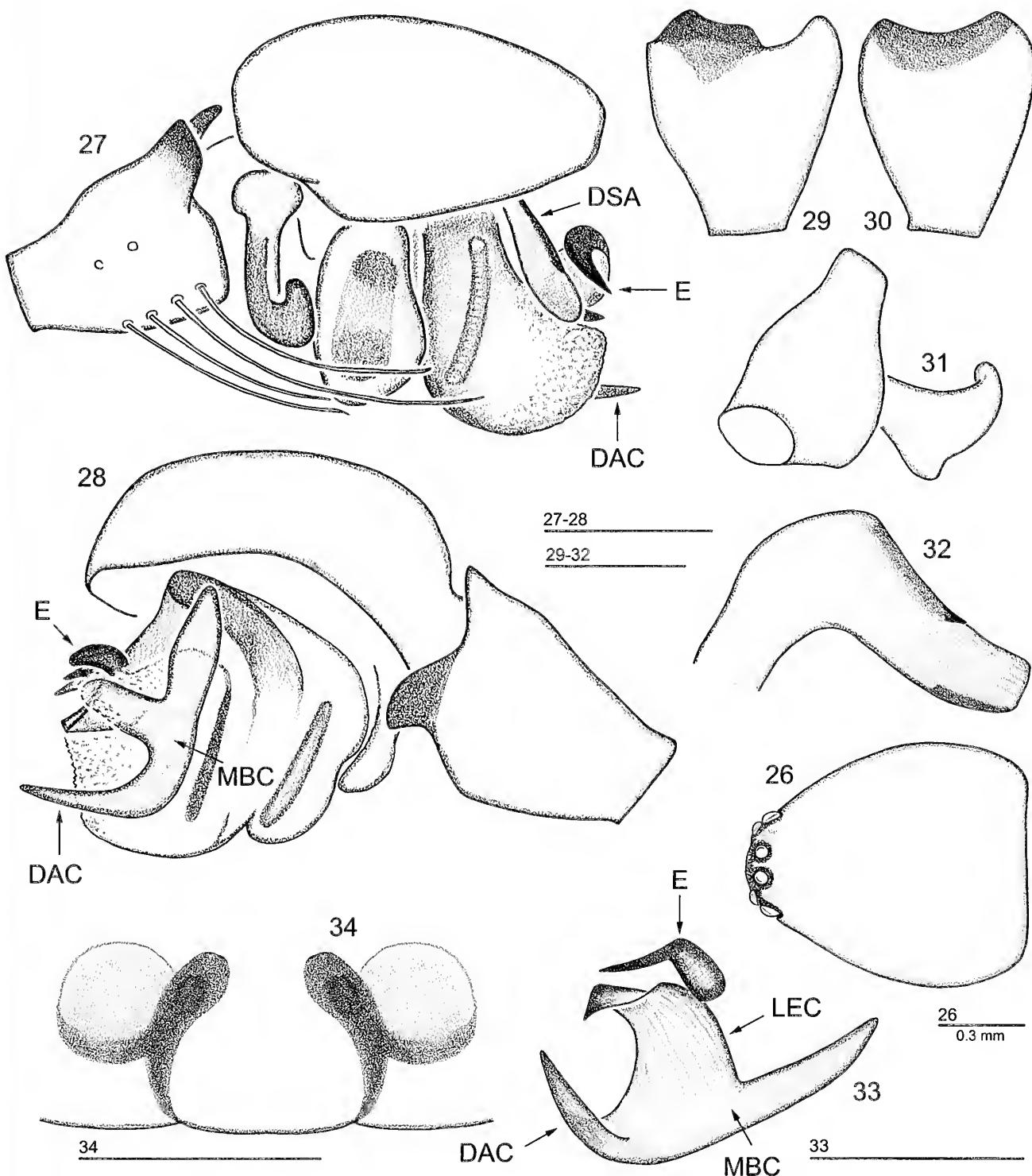
Oedothorax cunur sp. nov.

Figs 26-34

Holotype: Male; INDIA, Madras, Nilgiri, Coonoor, 1600 m a.s.l., sifting in forest below town; 22.XI.1972; leg. C. Besuchet & I. Löbl [#43].



Figs 16-25. *Oedothorax cornutus* sp. nov., male holotype (16-24), female paratype (25). (16-18) Carapace, lateral, dorsal and frontal views, respectively. (19-20) Right palp, retro- and pro-lateral views, respectively. (21-22) Palpal tibia, dorsal view, different aspects. (23) Palpal tibia and paracymbium, caudal-retrolateral view. (24) Distal suprategular apophysis. (25) Epigyne, ventral view.



Figs 26-34. *Oedothorax cunur* sp. nov., male holotype (26-33), female paratype (34). (26) Carapace, dorsal view. (27-28) Right palp, retro- and prolateral views, respectively. (29-30) Palpal tibia, dorsal views, different aspects. (31) Palpal tibia and paracymbium, caudal-retrolateral view. (32) Distal suprategular apophysis. (33) Embolic division. (34) Epigyne, ventral view.

Paratype: 1 female, collected together with the holotype.

Diagnosis: The species is characterized by the unmodified carapace and palpal tibia, by the massive, distally membranous tegulum and by the specific shape of the convector in the male, as well as by the small value of TmI in both sexes.

Etymology: The specific name is a noun in apposition, consonant with the name of the locality where the species was collected.

Description: Male (holotype). Total length 2.00. Carapace 1.00 long, 0.88 wide, pale brown, unmodified, eyes normal (Fig. 26). Chelicerae 0.40 long, unmodified. Legs yellow. Leg I 3.74 long ($1.00+0.28+0.95+0.88+0.63$), IV 3.83 long ($1.03+0.30+1.00+1.00+0.50$). Chaetotaxy: spines mostly lost, but should be 2.2.1.1. All metatarsi with a trichobothrium. TmI 0.49. Palp (Figs 27-33): Tibia with a shallow invagination apically and a flat twin-cone outgrowth displaced to prolateral side. Paracymbium simple, hook-shaped. Tegulum expanded in distal part, membranous. Distal suprategular apophysis with almost parallel edges, bearing a small pointed tooth in middle. Embolus small, curved, its radical part slightly expanded. Main body of convector long and narrow; distal apophysis bent at 90° to axis of segment, long, narrowing gradually. Lateral extension wide and flat, slightly curved distally. Abdomen 1.15 long, 0.73 wide, dorsally pale, almost white, with a pair of grey spots in anterior part, and with interrupted transverse stripes posteriorly.

Female. Total length 2.18. Carapace 1.05 long, 0.83 wide. Chelicerae 0.45 long, unmodified. Leg I 3.31 long ($0.88+0.30+0.83+0.75+0.55$), IV 3.41 long ($0.85+0.28+0.88+0.90+0.50$). Chaetotaxy: 2.2.1.1, length of spines 1-2 times diameter of segment. All metatarsi with a trichobothrium. TmI 0.64. Abdomen 1.33 long, 0.85 wide. Epigyne as in Fig. 34: median plate with gradually curved lateral sides, receptacles spherical. Body and leg coloration as in male.

Distribution: Only known from the type locality.

Oedothorax falciferoides sp. nov.

Figs 35-43

Holotype: Male; INDIA, Himalayas, West Bengal, Darjeeling Distr., Mahanadi near Kurseong, southern slope, 1200 m a.s.l., sifting in forest; 19.X.1978; leg. C. Besuchet & I. Löbl [#20].

Diagnosis: The new species is characterized by the peculiar shape of the male carapace, by the small embolus with strongly reduced embolus proper and by the specific structure of the convector.

Etymology: The specific name refers to the resemblance with the Nepalese *O. falcifer* Tanasevitch, 1998.

Description: Male (holotype). Total length 1.75. Carapace 0.85 long, 0.68 wide, pale brown, cephalic part with a small elevation bearing large posterior median eyes (Figs 35-37). Chelicerae 0.33 long, unmodified. Legs pale brown. Leg I 3.13 long ($0.80+0.25+0.75+0.80+0.53$), IV 3.16 long ($0.85+0.23+0.77+0.83+0.48$). Chaetotaxy 2.2.1.1, length of spines 1.5-2.5 times diameter of segment. Metatarsal trichobothrium not found on any legs. Palp (Figs 38-43): Tibia short, with narrow, long, stiletto-like apical apophysis directed retrolaterally. Paracymbium small, hook-shaped. Distal suprategular apophysis wide, flat, with two dark folds. Radical part of embolus very small, drop-shaped, embolus proper strongly reduced. Convector with a massive body, lateral extension narrow, directed forward, distal apophysis awl-shaped. Abdomen 0.95 long, 0.55 wide, with indistinct, irregular, grey pattern.

Female unknown.

Taxonomic remarks: This species is most similar to *O. falcifer* Tanasevitch, 1998, known from Ilam District, Nepal (Tanasevitch, 1998), but differs by its small cephalic elevation on the carapace, by its wider stiletto-like tibial apophysis, as well as by the reduced embolus proper.

Distribution: Only known from the type locality.

Oedothorax kodaikanal sp. nov.

Figs 44-50

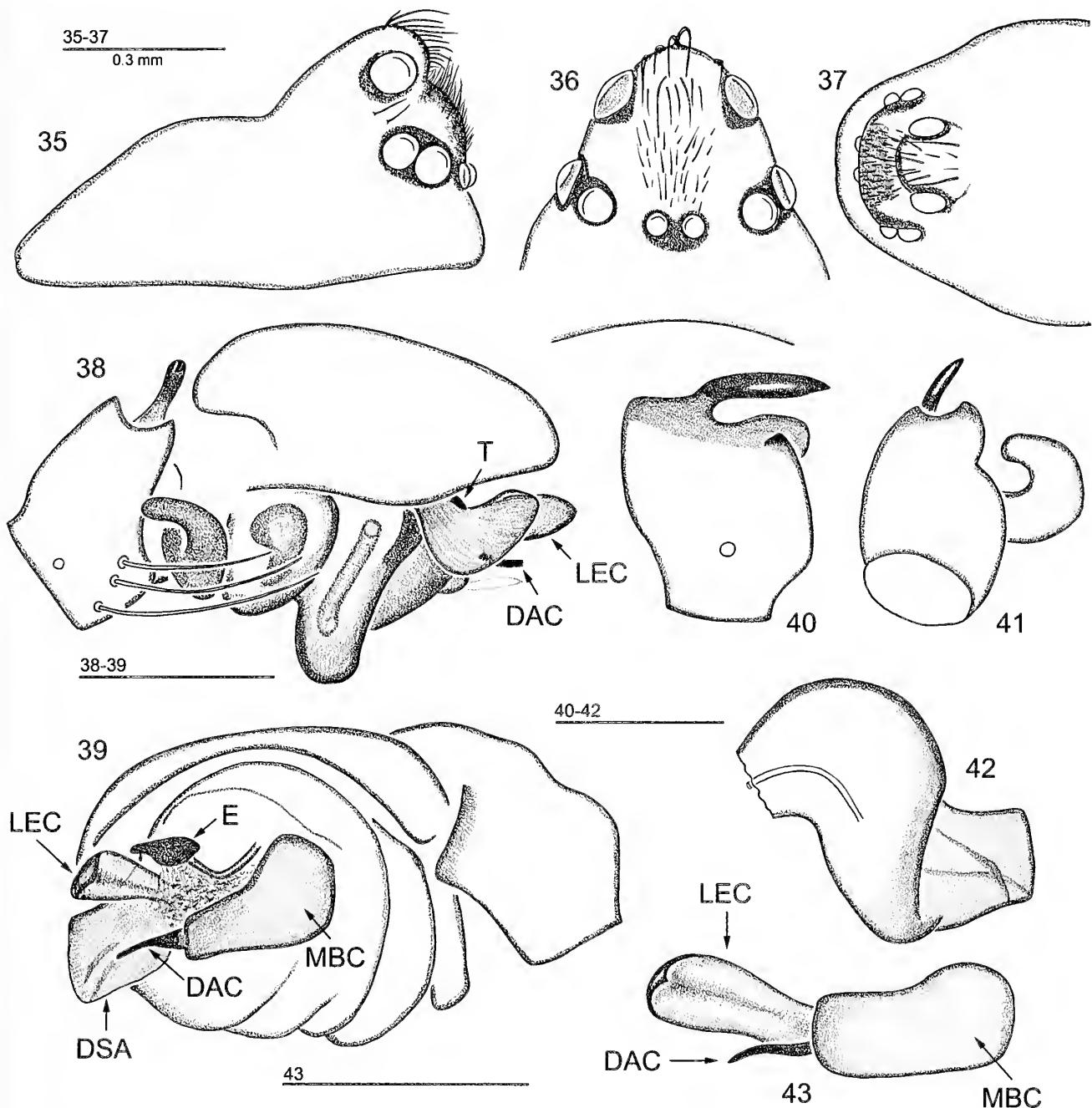
Holotype: Male; INDIA, Madras, Palni Hills, 10 km NW of Kodaikanal, 2150 m a.s.l., edge of *Rhododendron* forest with fern, sifting litter near river; 15.XI.1972; leg. C. Besuchet & I. Löbl [1972/27].

Paratype: 2 males, one of them in ZMMU; Madras, Palni Hills, 23 km W of Kodaikanal, Lake Berijam, 2150 m a.s.l., *Rhododendron* forest, sifting litter; 14.XI.1972; leg. C. Besuchet & I. Löbl [1972/26].

Diagnosis: Males of the new species can be easily recognized by the unmodified carapace, the hypertrophied lateral extension of the convector which projects from the apex of the palp, as well as by the band-like embolus.

Etymology: The specific name is a noun in apposition taken from the name of the type locality.

Description: Male (holotype). Total length 2.30. Carapace 1.20 long, 0.85 wide, unmodified, pale brown; eyes normal (Fig. 44). Chelicerae 0.45 long, unmodified. Legs yellow. Leg I 3.78 long ($1.05+0.30+0.93+0.88+0.62$), IV 3.88 long ($1.07+0.30+0.93+0.98+0.60$). Chaetotaxy 2.2.1.1,



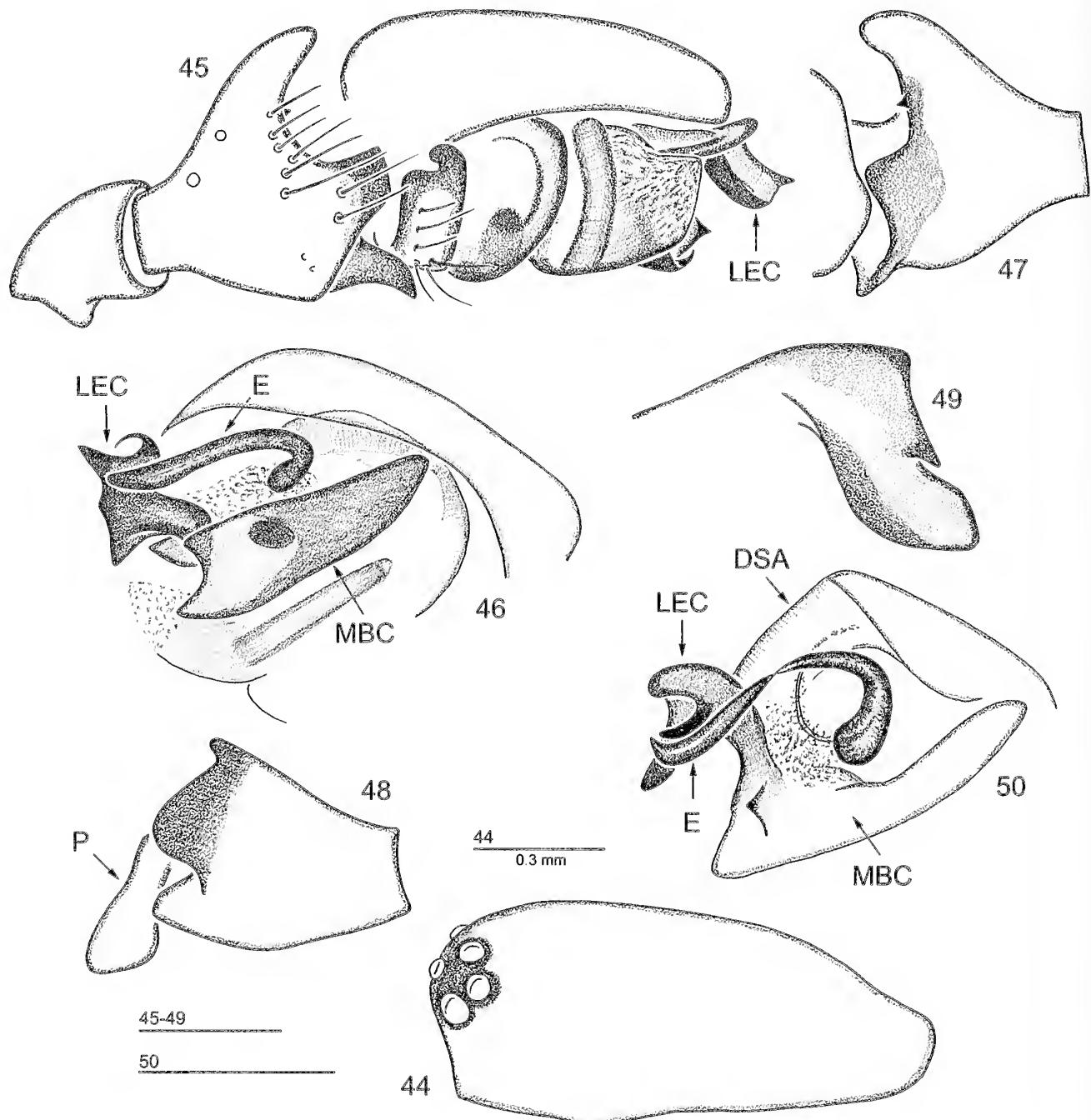
Figs 35-43. *Oedothorax falciferoides* sp. nov., male holotype. (35-37) Carapace, lateral, frontal and dorsal views, respectively. (38-39) Right palp, retro- and prolateral views, respectively. (40) Palpal tibia, dorsal view. (41) Palpal tibia and paracymbium, caudal-retrolateral view. (42) Distal suprategular apophysis. (43) Convector.

spines stout, their length 1.5-2.5 times diameter of segment. All metatarsi with a trichobothrium. TmI 0.52. Palp (Figs 45-50): Tibia with a conical dorsal outgrowth and a truncated retrolateral extension. Prolateral edge of tibia with a small pointed tooth. Paracymbium small, L-shaped. Tegulum membranous distally. Embolic division with a small radix and a relatively long, wide, flat embolus. Main body of convector massive, with a well-sclerotized lateral extension of complex form directed forward. Abdomen 1.33 long, 0.80 wide,

dorsally pale, with two pairs of grey paramedian spots in anterior part and with transverse stripes posteriorly. Female unknown.

Variability: The retrolateral tibial outgrowth can be somewhat shorter, the prolateral tibial tooth can be slightly larger than in the holotype.

Distribution: Only known from high altitudes of the Palni Hills in Madras (currently Tamil Nadu), India.



Figs 44-50. *Oedothorax kodaikanal* sp. nov., male holotype. (44) Carapace, lateral view. (45-46) Right palp, retro- and prolateral views, respectively. (47) Palpal tibia, prolateral view. (48) Palpal tibia and paracymbium, ventral view. (49) Distal suprategular apophysis. (50) Distal suprategular apophysis and embolic division.

Oedothorax lopchu sp. nov.

Figs 51-60

Holotype: Male; INDIA, Himalayas, West Bengal, Darjeeling Distr., between Ghoom and Lopchu, 13 km from Ghoom, northern slope, 2000 m a.s.l., sifting in forest; 14.X.1978; leg. C. Besuchet & I. Löbl [#14b].

Paratype: 1 male, collected together with the holotype. – 1 male; same locality; 12.X.1978; leg. C. Besuchet & I. Löbl [#12].

Diagnosis: The species is characterized by its slightly modified male carapace, by the shape of the main body of the convector, as well as by the relatively long embolus.

Etymology: The specific name is a noun in apposition taken from the name of the type locality.

Description: Male (paratype). Total length 1.95. Carapace 0.93 long, 0.75 wide, reddish brown with indistinct grey radial stripes. Anterior part of carapace

slightly elevated, eyes enlarged (Fig. 51). Chelicerae 0.37 long, unmodified. Legs pale brown. Leg I 3.91 long ($0.98+0.25+0.98+0.95+0.75$), IV 3.74 long ($1.00+0.25+0.98+0.98+0.53$). Chaetotaxy 2.2.1.1, length of spines 1.5-2 times diameter of segment. All metatarsi with a trichobothrium. TmI 0.53. Palp (Figs 52-60): Tibia short, with a narrow, long, claw-shaped apieal apophysis directed retrolaterally. Paraeymbium small, hook-shaped. Distal suprategular apophysis wide, flat, with a sharp tooth in middle. Embolus relatively long, curved. Main body of convector elongated, with a deep invagination medially; lateral extension flat, constricted basally; distal apophysis narrow, pointed, strongly sclerotized, slightly curved. Abdomen 1.08 long, 0.65 wide, dorsally pale, with three pairs of indistinct, large, grey spots.

Female unknown.

Distribution: Only known from the type locality.

Oedothorax meghalaya sp. nov.

Figs 61-69

Holotype: Male; INDIA, Meghalaya, above Shillong, Khasi Hills, near Shillong Peak, northern slope, 1850-1950 m a.s.l., primary forest, sifting litter; 25.X.1978; leg. C. Besuchet & I. Löbl [1978/27].

Paratype: 1 male, collected together with the holotype.

Etymology: The specific name is a noun in apposition taken from the name of the type locality.

Diagnosis: The new species is easily recognized among other congeners by the specific dorsal outgrowth on the palpal tibia, as well as by the wide distal apophysis of the convector terminating in two stylet-like projections on its edges.

Description: Male (paratype). Total length 2.15 (2.23 in holotype). Carapace 1.00 long, 0.75 wide, pale brown with greyish sides, cephalic elevation bearing posterior median eyes (Figs 61-62). Chelicerae 0.38 long, unmodified. Legs pale brown. Leg I 3.73 long ($1.00+0.25+0.93+0.93+0.62$), IV 3.85 long ($1.02+0.25+1.00+1.00+0.58$). Chaetotaxy 2.2.1.1, length of spines 1.5-2.5 times diameter of segment. All metatarsi with a triehobothrium. TmI 0.61. Palp (Figs 63-69): Tibia with a dorsal vertical outgrowth narrowing and curved distally. Paracymbium large, distal part bearing several small spines. Distal suprategular apophysis short, truncated, with obtuse tooth in middle. Radix small, embolus proper strong, almost straight. Distal apophysis of convector broad, with two sharp projections on its edges. Abdomen 1.25 long, 0.80 wide, dorsally pale, with three pairs of large, grey paramedian spots merged into two longitudinal stripes.

Female unknown.

Distribution: Only known from the type locality.

Oedothorax paracymbialis sp. nov.

Figs 70-74

Holotype: Male; INDIA, Madras, Nilgiri, Hulical near Coonoor, right bank of Coonoor River, 1600 m a.s.l., forest in ravin, sifting; 22.XI.1972; leg. C. Besuchet & I. Löbl [#44].

Diagnosis: The new species is well distinguished by the peculiar shape of the palpal tibia and of the paracymbium, as well as by the reduced lateral extension of the convector.

Etymology: The specific name, an adjective, refers the peculiar shape of the paracymbium.

Description: Male (holotype). Total length 1.68. Carapace 0.73 long, 0.63 wide, bright yellow. Cephalic part of carapace with a small elevation behind eye group bearing a curved spine directed forward (Fig. 70). Eyes slightly enlarged. Chelicerae 0.25 long, unmodified. Legs pale yellow. Leg I 3.20 long ($0.90+0.25+0.80+0.75+0.50$), IV 3.09 long ($0.85+0.23+0.83+0.80+0.38$). Chaetotaxy 2.2.1.1, length of spines 1.5-2 times diameter of segment. All metatarsi with a trichobothrium. TmI 0.58. Palp (Figs 71-74): Tibia with a conical outgrowth apically. Distal part of paracymbium massive, claw-shaped terminally. Distal suprategular apophysis rounded, with a sharp tooth in middle. Radical part of embolus somewhat expanded, embolus relatively long, curved. Main body of convector elongated, narrow, slightly curved, it distal part strongly sclerotized, twisted; lateral extension reduced. Abdomen 1.03 long, 0.65 wide, dorsally pale, with grey herring-bone pattern.

Female unknown.

Distribution: Only known from the type locality.

Oedothorax rusticus sp. nov.

Figs 8, 75-82

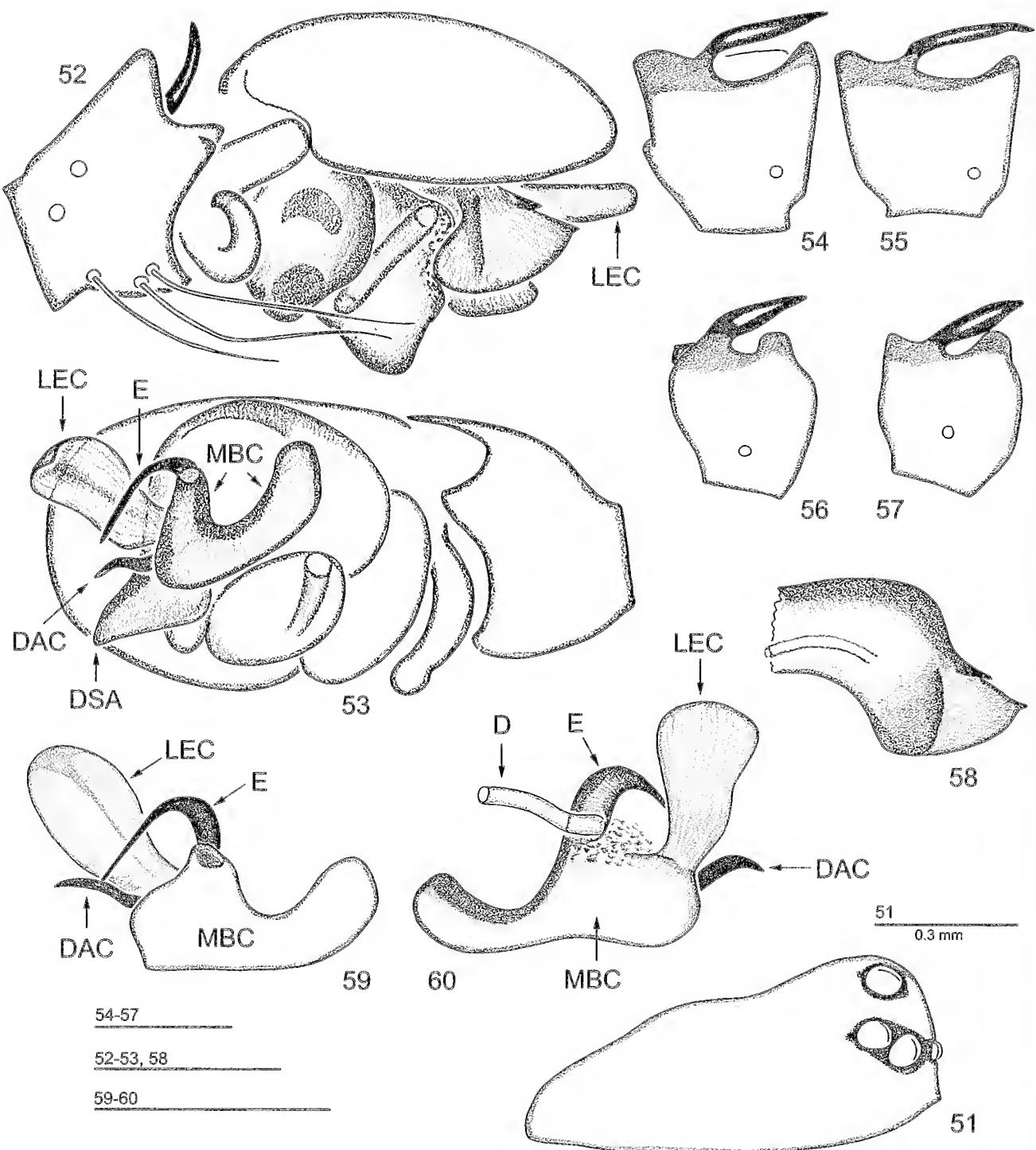
Holotype: Male; INDIA, Madras, Palni Hills, Kodaikanal, 2100 m a.s.l., sifting in forest above town; 11.XI. 1972; leg. C. Besuchet & I. Löbl [#22].

Paratypes: 3 males, 8 females (1 male and 1 female in ZMMU) collected together with the holotype.

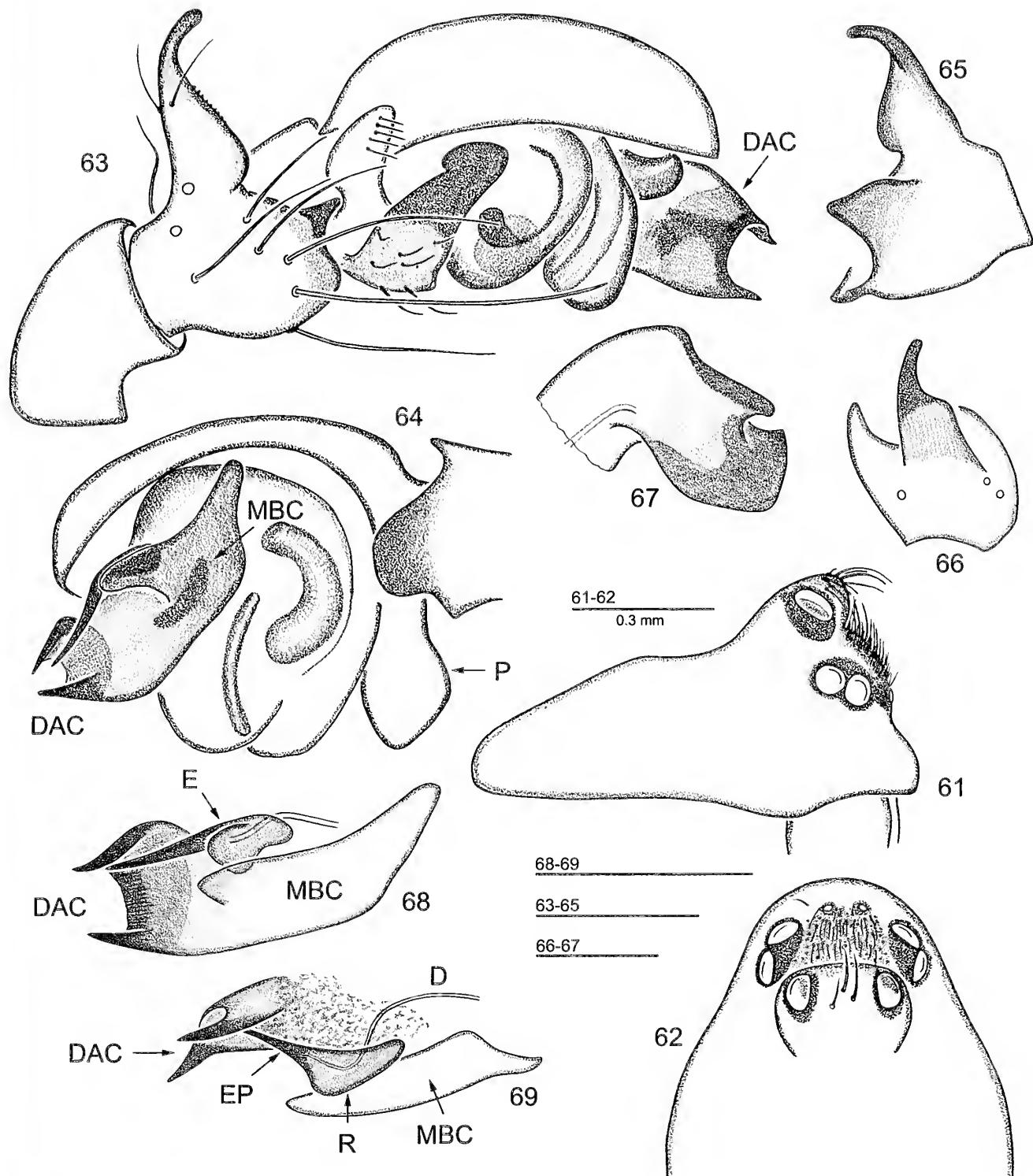
Diagnosis: Males of the new speeies are characterized by the slightly modified carapace, by the spination of the paracymbium, as well as by the specific structure of the convector.

Etymology: The specific name is a Latin adjective meaning "simple, unpretentious" referring to the ordinary structure of the genitalia in this species.

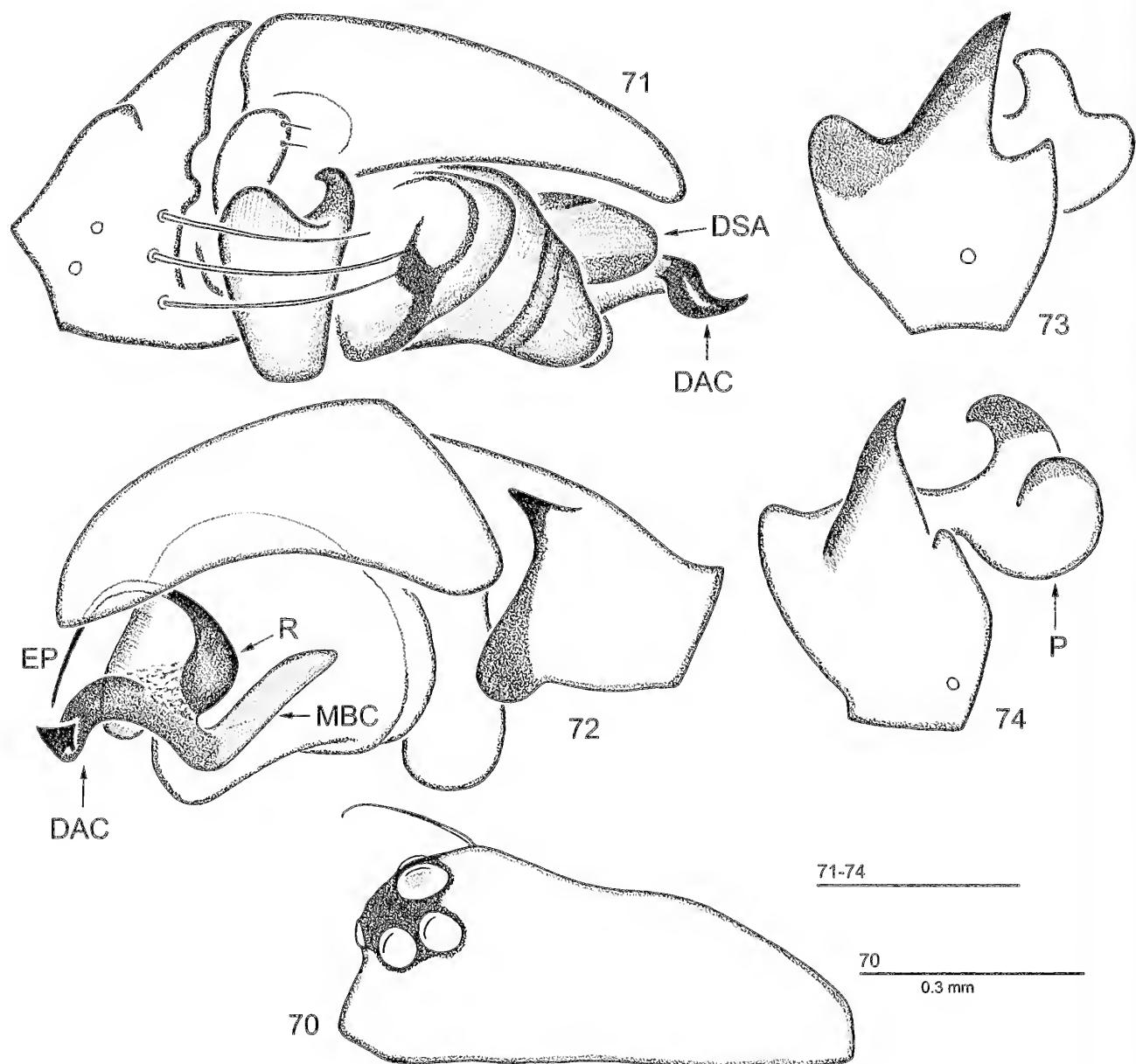
Description: Male (paratype). Total length 2.00 (1.93, 2.00, 2.13 in other paratypes). Carapace 0.90 long, 0.75 wide, pale brown, with indistinct grey



Figs 51-60. *Oedothorax lopchu* sp. nov., male paratype. (51) Carapace, lateral view. (52-53) Right palp, retro- and prolateral views, respectively. (54-57) Palpal tibia, dorsal view, different aspects. (58) Distal suprategular apophysis. (59-60) Embolic division, different aspects.



Figs 61-69. *Oedothorax meghalaya* sp. nov., male paratype. (61-62) Carapace, lateral and dorsal views, respectively. (63-64) Right palp, retro- and prolateral views, respectively. (65-66) Palpal tibia, prolateral and dorsal views, respectively. (67) Distal suprategular apophysis. (68-69) Embolic division, different aspects.



Figs 70-74. *Oedothorax paracymbialis* sp. nov., male holotype. (70) Carapace, lateral view. (71-72) Right palp, retro- and prolateral views, respectively. (73-74) Palpal tibia and paracymbium, caudal-retrolateral view, different aspects.

radial stripes. Cephalic part of carapace moderately elevated, eyes somewhat enlarged (Fig. 75). Chelicerae 0.35 long, unmodified. Legs yellow. Leg I 3.56 long ($0.95+0.25+0.93+0.88+0.55$), IV 3.61 long ($1.00+0.23+0.93+0.95+0.50$). Chaetotaxy 2.2.1.1, spines stout, their lengths 1.5-2.5 times diameter of segment. All metatarsi with a trichobothrium. TmI 0.67. Palp (Figs 8, 76-80): Tibia with a strong, stiletto-like apical apophysis directed retrolaterally. Paracymbium simple, its distal part bearing several short, curved spines. Distal suprategular apophysis constricted in middle, bearing a small sharp tooth at constriction, rounded distally. Embolus small, bent at 90° , its radical

part slightly expanded. Convector with a massive lateral extension, distal apophysis strongly sclerotized, twisted. Abdomen 1.13 long, 0.75 wide, dorsally pale, with a longitudinal row of three pairs of large grey spots. Female. Total length 2.33 (2.00, 2.15 in two other paratypes). Carapace 0.98 long, 0.78 wide, unmodified. Chelicerae 0.40 long, unmodified. Leg I 3.57 long ($0.95+0.28+0.93+0.83+0.58$), IV 3.81 long ($1.05+0.30+0.98+0.95+0.53$). TmI 0.73. Abdomen 1.35 long, 0.75 wide. Epigyne as in Figs 81-82: median plate with gradually curved lateral sides, receptacles spherical. Body and leg coloration, as well as chaetotaxy, as in male.

Taxonomic remarks: The new species is similar to *O. cornutus* sp. nov. and *O. villosus* sp. nov., but differs clearly by the unmodified carapace and by the spination of the paracymbium in males, as well as by the gradually curved lateral sides of the median plate in females. The shape of the epigyne is ordinary for the genus and somewhat similar to the geographically adjacent *O. cunur* sp. nov.

Distribution: Only known from the type locality.

***Oedothorax stylus* sp. nov.**

Figs 83-85

Holotype: Male; INDIA, Kerala, NW of Nelliampathi Hills, Kaikatty, 900 m a.s.l.; sifting in forest, near a spring; 30.XI.1972; leg. C. Besuchet & I. Löbl [1972/58].

Paratype: 1 female, collected together with the holotype. – 1 male; Madras, Anaimalai Hills, 18 km N of Valparai, 1250 m a.s.l., forest, sifting litter; 18.XI.1972; leg. C. Besuchet & I. Löbl [1972/35].

Diagnosis: The new species is characterized by lacking apophyses on the palpal tibia, by the long, straight and thin distal apophysis of the convector in males. Females can be easily distinguished by the presence of narrow, long, parallel, sclerotized stripes on the cuticle at both sides of the epigyne.

Etymology: The species name is a Latin noun; one of its many meanings is “awl” which refers to the shape of the distal apophysis of the convector.

Description: Male (holotype). Carapace 0.80 long, 0.65 wide, unmodified, pale yellow. Eyes slightly enlarged. Chelicerae 0.28 long, unmodified. Legs yellow. Leg I 2.58 long (0.70+0.23+0.60+0.60+0.45), IV 2.58 long (0.70+0.23+0.62+0.65+0.38). Chaetotaxy 2.2.1.1, length of spines 1.5-2.5 times diameter of segment. All metatarsi with a trichobothrium. TmI 0.53. Palp (Figs 83-84): Tibia lacking any apophyses, bearing small denticles terminally on dorsal side. Paraeymbium small, L-shaped. Embolus very small, embolus proper thin and short. Distal part of convector thin, long, awl-shaped. Abdomen lost. Dorsal abdominal pattern of male paratype consisting of two pairs of grey paramedian spots in anterior part and interrupted transverse stripes posteriorly.

Female. Total length 2.00. Carapace 0.83 long, 0.63 wide, pale brown, unmodified. Eyes slightly enlarged. Chelicerae 0.38 long, unmodified. Legs yellow. Leg I 3.06 long (0.88+0.25+0.78+0.70+0.45), IV 3.23 long (0.90+0.25+0.80+0.83+0.45). TmI 0.52. Abdomen 1.25 long, 0.85 wide, dorsally pale, with two indistinct grey longitudinal stripes. Epigyne as in Fig. 85: Two narrow, long, sclerotized, parallel stripes present on cuticle at both sides of median plate. Median plate wider than long,

receptacles small, oblong. Body and leg coloration, as well as chaetotaxy, as in male.

Taxonomic remarks: The new species is similar to *O. uncus* sp. nov. (see below).

Distribution: At present only known from Kerala and Madras (currently Tamil Nadu), India.

***Oedothorax uncus* sp. nov.**

Figs 86-88

Holotype: Male; INDIA, Meghalaya, Khasi Hills, Mawphlang, 1800 m a.s.l., forest, sifting litter; 28.X.1978; leg. C. Besuchet & I. Löbl [1978/32b].

Paratype: 1 female, collected together with the holotype.

Etymology: The species name is a Latin noun meaning “hook”; it refers to the shape of the distal apophysis of the convector.

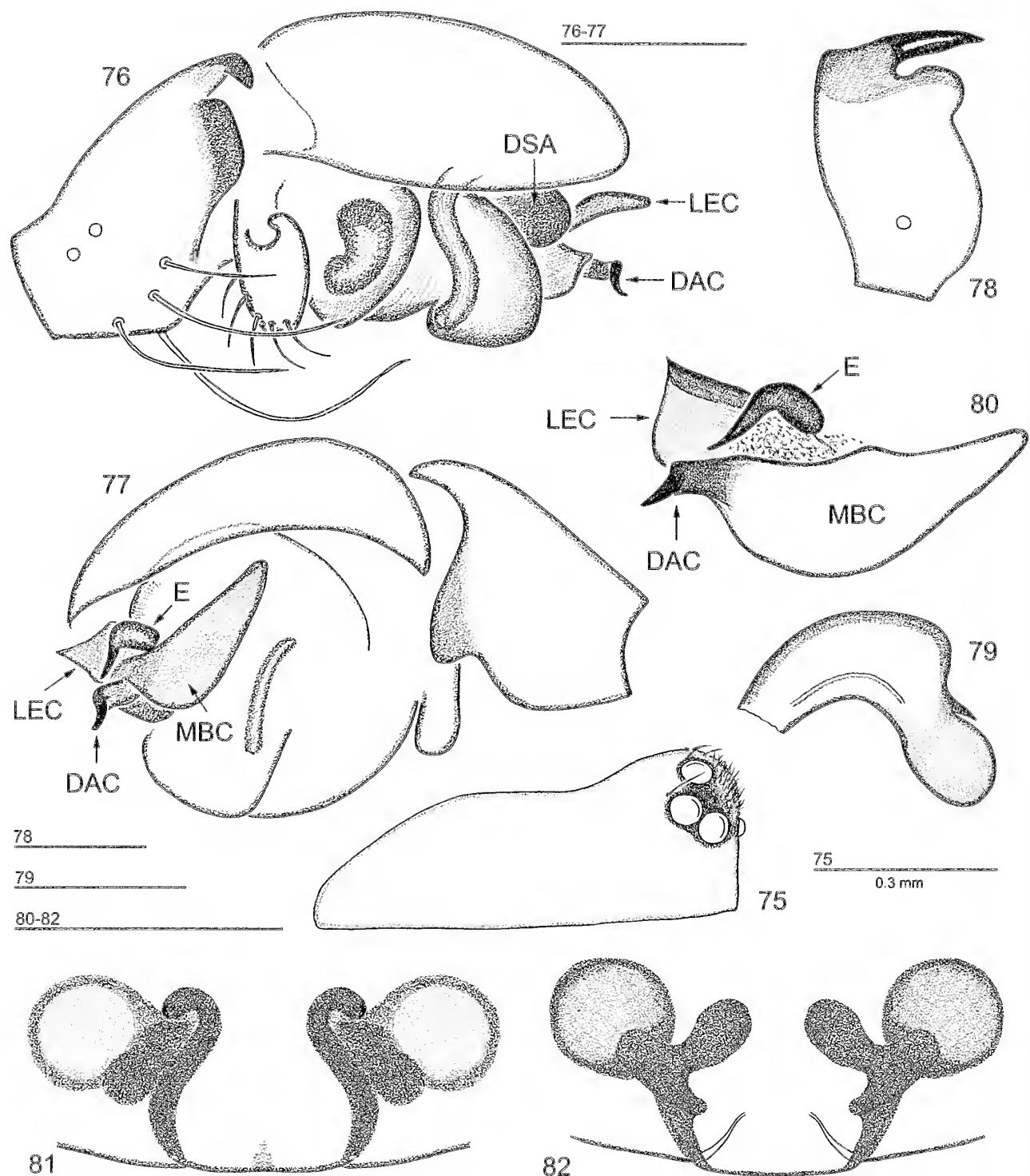
Diagnosis: The new species can be easily distinguished by the long, hook-shaped distal apophysis of the convector in males, as well as by the anchoriform median plate of the epigyne in females.

Description: Male (holotype). Total length 2.25. Carapace 0.98 long, 0.80 wide, unmodified, yellow with indistinct grey radial stripes. Chelicerae 0.50 long. Legs yellow. Leg I 3.78 long (0.95+0.30+1.00+0.88+0.65), IV 2.88 long (0.80+0.25+0.70+0.73+0.40). Chaetotaxy 2.2.1.1, spines stout, their length 1.5-2.5 times diameter of segment. All metatarsi with a trichobothrium. TmI 0.68. Palp (Figs 86-87): Tibia elongated dorsally, with several small denticles apically. Paracymbium simple, hook-shaped. Frontal surface of tegulum membranous. Distal suprategular apophysis short, rounded distally. Embolus very small, embolus proper short, obtuse. Distal apophysis of convector long, curved, gradually narrowing and strongly projecting. Abdomen 1.18 long, 0.83 wide, dorsally pale, with two pairs of isolated grey spots in anterior part and several merging grey spots posteriorly.

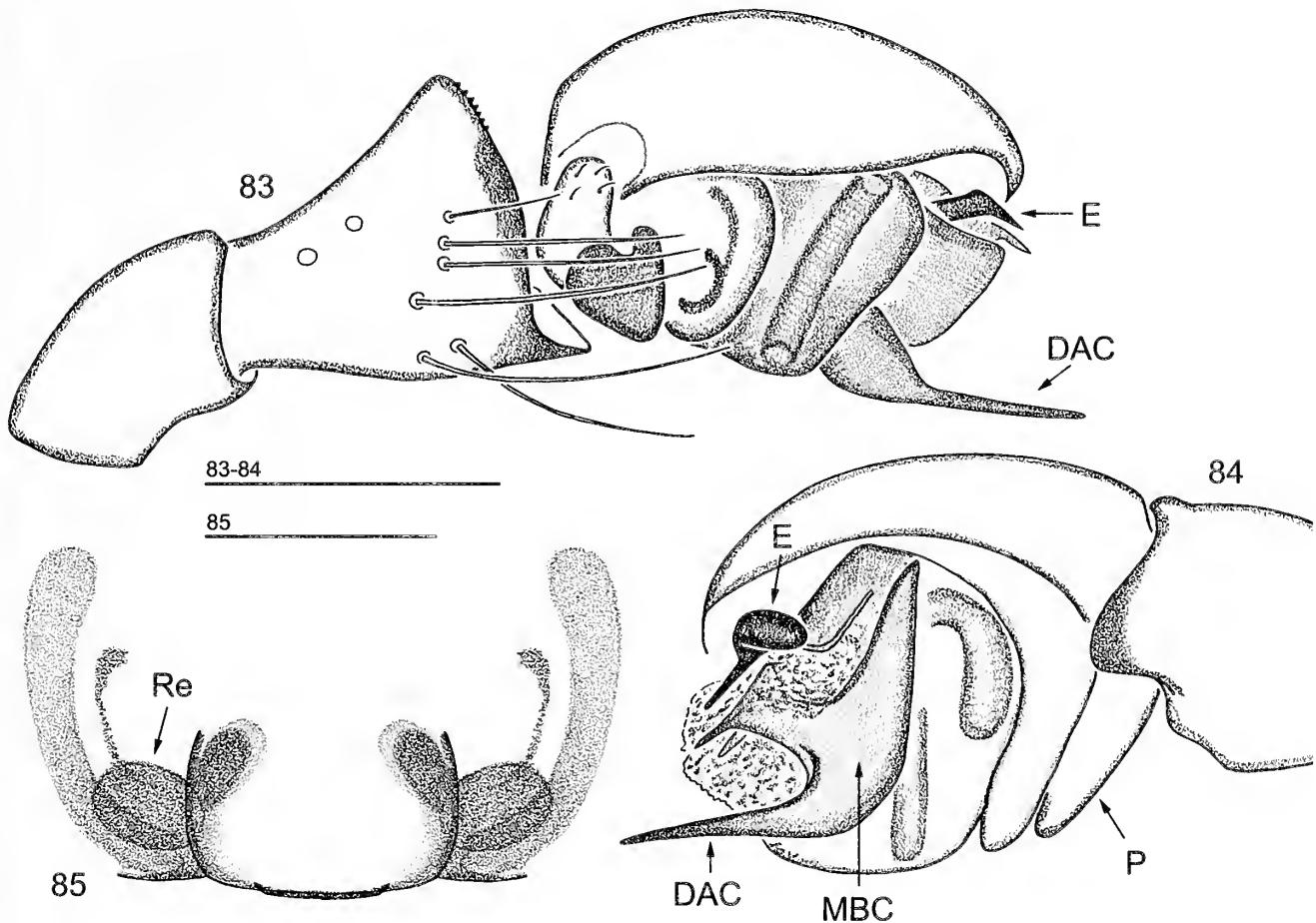
Female. Total length 2.30. Carapace 1.00 long, 0.78 wide, unmodified. Chelicerae 0.45 long, unmodified. Leg I 3.52 long (0.93+0.30+0.88+0.88+0.53), IV 3.73 long (1.08+0.30+0.90+0.95+0.50). TmI 0.68. Abdomen 1.18 long, 0.75 wide. Epigyne as in Fig. 88: median plate wider than long. Body and leg coloration, as well as chaetotaxy, as in male.

Taxonomic remarks: The new species is similar to *O. stylus* sp. nov., but clearly differs by the presence of a dorsal outgrowth on the palpal tibia, and by the hook-shaped distal apophysis of the convector in the male, as well as by the absence of narrow, long, sclerotized, parallel stripes at both sides of the median plate of the epigyne in the female.

Distribution: Only known from the type locality.



Figs 75-82. *Oedothorax rusticus* sp. nov., male (75-80) and female (81-82) paratypes. (75) Carapace, lateral view. (76-77) Right palp, retro- and pro-lateral views, respectively. (78) Palpal tibia, dorsal view. (79) Distal suprategular apophysis. (80) Embolic division. (81-82) Epigyne, ventral and dorsal views, respectively.



Figs 83-85. *Oedothorax stylus* sp. nov., male holotype (83-84), female paratype (85). (83-84) Right palp, retro- and prolateral views, respectively. (85) Epigyne, ventral view.

Oedothorax villosus sp. nov.

Figs 89-99

Holotype: Male; INDIA, Himalayas, West Bengal, Darjeeling Distr., Algarah, 1800 m a.s.l., sifting in forest; 9.X.1978; leg. C. Besuchet & I. Löbl [#6].

Paratypes: 2 males, 2 females, collected together with the holotype.

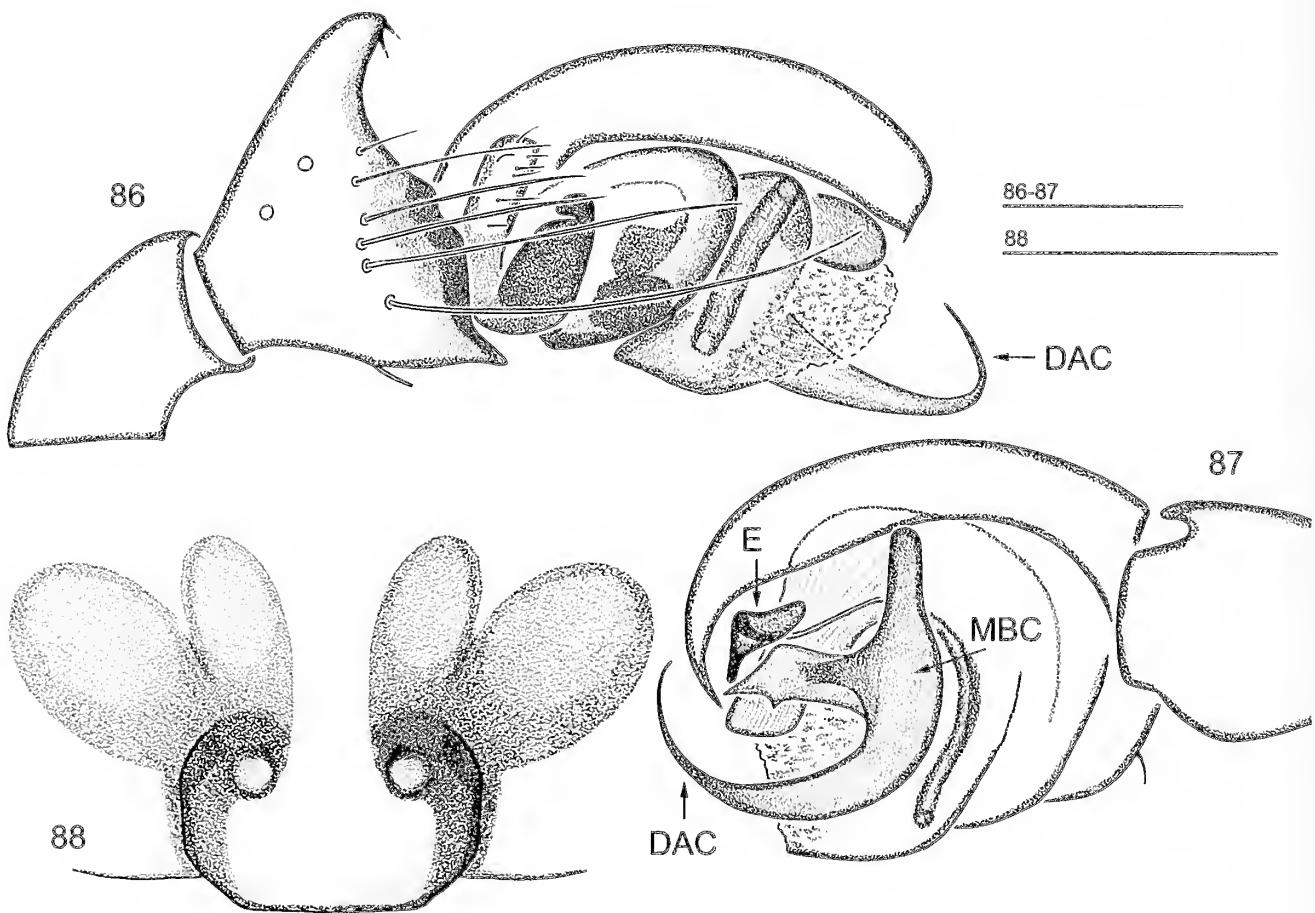
Diagnosis: The new species is characterized by the strongly modified male carapace, which carries a pair of short, thick, curved setae resembling horns behind the eyes and two small sharp projections on the back side of the semiglobular postocular elevation.

Etymology: The specific name is a Latin adjective meaning “hairy”, referring to the hirsuteness of the sternum and abdomen in both sexes.

Description: Male (paratype). Total length 2.00 (2.05 in one other paratype). Carapace 0.90 long, 0.78 wide, pale brown with indistinct grey radial stripes, strongly modified. Cephalic part of carapace with a pair of curved, horn-shaped setae behind posterior median eyes; a pale semiglobular postocular elevation

bearing two small sharp projections on its back side; remaining part of carapace conically prominent (Figs 89-91). Chelicerae 0.35 long, unmodified. Sternum bearing thin, long hairs. Legs yellow. Leg I 3.96 long ($1.10+0.28+1.00+0.95+0.63$), IV 3.87 long ($1.08+0.25+0.98+1.03+0.53$). Chaetotaxy 2.2.1.1, length of spines 1.5-2.5 times diameter of segment. All metatarsi with a trichobothrium. TmI 0.75. Palp (Figs 92-97): Tibia short, with a strong, stiletto-like apical apophysis directed retrolaterally. Paracymbium relatively small, hook-shaped. Distal suprategular apophysis flat, pointed apically, with a small sharp tooth medially. Embolus small, bent at 90°, its radical part slightly expanded. Convector elongated, narrow, slightly curved in middle; lateral extension flat, flag-shaped, situated distally. Abdomen 1.10 long, 0.75 wide, bearing thin and long hairs, dorsally pale, with two pairs of irregular grey spots in anterior part and several transversal stripes posteriorly.

Female. Total length 2.23 (2.33 in other paratype). Carapace 0.95 long, 0.75 wide, unmodified. Chelicerae 0.38 long. Leg I 3.48 long ($0.95+0.25+0.90+0.83+0.55$), IV 3.58 long ($1.00+0.25+0.90+0.93+0.50$). TmI 0.75. Abdomen 1.38 long, 0.88 wide. Epigyne as in Figs 98-



Figs 86-88. *Oedothorax uncus* sp. nov., male holotype (86-87), female paratype (88). (86-87) Right palp, retro- and pro-lateral views, respectively. (88) Epigyne, ventral view.

99: median plate with inclined lateral sides, receptacles small, oblong. Body and leg coloration, as well as chaetotaxy, as in male.

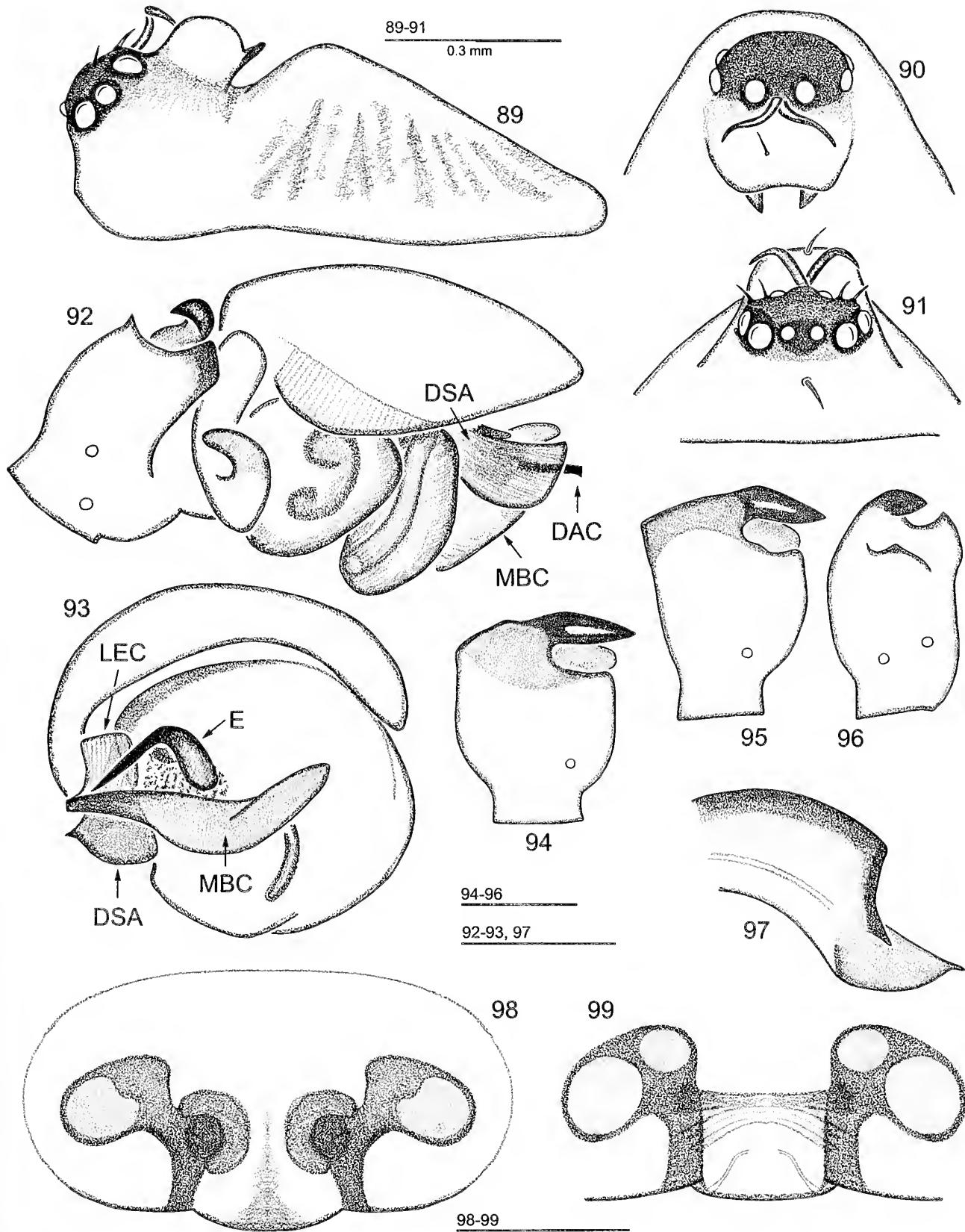
Variability: The shape of the male carapace is similar in all specimens examined; only slight differences can be observed in the roundness of the postocular cephalic elevation and in the size of the sharp projections on its back side.

Taxonomic remarks: The new species is similar to *O. cornutus* sp. nov. (see above), distinguished by the longer, not appressed horn-shaped setae; by the position of the carapace slit which is situated behind of the postocular elevation, while in *O. cornutus* the slit is before that; by the thicker stiletto-like tibial apophysis of the male palp, as well as by the oblong receptacula in females, while in *O. cornutus* receptacula are almost spherical.

Distribution: Only known from the type locality.

CONCLUSION

The present study adds four new species to the genus *Oedothorax* in the Himalayan region, which currently contains no fewer than 27 species. This is substantially more than in the remaining Palaearctic (22 species). When disregarding such “problematic” species like *O. caporiaccoi* Roewer, 1942, *O. insignis* (Bösenberg, 1902), *O. insulanus* Paik, 1980, *O. japonicus* Kishida, 1910, *O. tener* (Bösenberg, 1902) and some others, the Himalayan centre of *Oedothorax* speciation appears to be even more significant. The Oriental *Oedothorax* fauna currently comprises eight species, i.e. seven described here from Meghalaya, Madras and Kerala, as well as *O. convector* Tanasevitch, 2014 from Thailand (Tanasevitch, 2014a). All Oriental species of the genus were found on mountains at 900–2150 m a.s.l. Interestingly, all Himalayan and Oriental *Oedothorax* species are distinguished from the Palaearctic congeners by the development of a distinct dorsal abdominal pattern (see Figs 9–15); the extra-Himalayan Palaearctic representatives show only a light longitudinal stripe on a grey dorsal side of the abdomen at best.



Figs 89-99. *Oedothorax villosus* sp. nov., male (89-97) and female paratype (98-99) paratypes. (89-91) Carapace, lateral, dorsal and frontal views, respectively. (92-93) Right palp, retro- and prolateral views, respectively. (94-96) Palpal tibia, dorsal view, different aspects. (97) Distal suprategular apophysis. (98-99) Epigyne, ventral and dorsal views, respectively.

Changes in colour or appearance of the dorsal abdominal pattern in the eastern populations of some Palaearctic taxa are long known from linyphiids. For example, the East Palaearctic populations of *Kaestneria pullata* (O. P.-Cambridge, 1863) differ from the West Palaearctic ones by a yellowish orange tinge of the carapace and legs. Eventually, this led Kulczyński (1885) to describe the Kamchatka population of *K. pullata* as a new species, *K. anceps* Kulczyński, 1885. Amplification or the appearance of a pattern is also known in some Micronetinae, e.g. *Agyneta mollis* (O. P.-Cambridge, 1871). In addition to the peculiar coloration, most Himalayan and Oriental species show a lateral extension on the convector, a character which is rather rare among other extra-Himalayan *Oedothorax*.

The above two characters of Himalayan *Oedothorax*, i.e., an abdominal pattern and the presence of a lateral extension on the convector, coupled with their geographical proximity to Oriental congeners, indicate that the Himalayan centre of *Oedothorax* speciation is closely related to the Oriental fauna. It is the Himalayas that seem to have supplied faunal elements for the Oriental region.

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On the genus *Styphlidius* Penecke, 1936 with description of *S. pelops* sp. nov. from Greece (Coleoptera, Curculionidae)

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Abstract: *Styphlidius brevisetis* Osella, 1981 and *S. globosus* Osella, 1981 are raised to species level. Both were hitherto ranked as subspecies of *S. corcyreus* (Reitter, 1884). *Styphlidius pelops* sp. nov. is described from the Peloponnese. All specimens of the new species were sifted from leaf litter, moss and plant debris. *Styphlidius corcyreus* is recorded for the first time from Albania. A revised key to all five species is presented and an overview of the species' distribution is given.

Keywords: Curculioninae - Styphlini - new species - changed ranks - taxonomy - Greece.

INTRODUCTION

The genus *Styphlidius* Penecke, 1936 was proposed by Penecke (1936) originally as subgenus of *Orthochaetes* Germar, 1824 for *Adexius corcyreus* Reitter, 1884. Solari (1950) treated *Styphlidius* as a proper genus. González (1967) revised part of the Styphlini Jekel, 1861 and included *Styphlidius* again as a subgenus of *Orthochaetes*. *Styphlidius* is most similar to the genera *Orthochaetes* and *Trachystyphlus* Alonso-Zarazaga & Lyal, 1999 and is characterised by the following traits: i) short, broad, strongly bulging, globose to oval and/or rhomboidal elytra; ii) intervals on elytra narrow and rib-like bulging; iii) uneven intervals with long raised bristles; iv) legs strong with laterally flattened tibiae, those set with long bowed bristles on the outer side; v) internal sac of penis with a single big, fishhook-like sclerite (Figs 10-15). *Styphlidius* is actually accepted as a proper genus, represented by four taxa according to Caldara (2013): Two species – *S. italicus* Osella, 1981 present in Italy including Sicily (Osella & Zuppa 1994) – and *S. corcyreus* s. str. (Reitter, 1884) with the two subspecies *brevisetis* Osella, 1981 and *globosus* Osella, 1981 in Greece. It was Osella (1981) who made the most recent revision and provided a determination key. Consequently, Colonnelli (2003) raised *S. italicus* consequently from subspecies (of *S. corcyreus*) to species level.

At present, the most widespread species in Greece is *S. corcyreus* s. str., whereas *brevisetis* and *globosus* are restricted to the Islands Kefalonia and Levkas respectively. From the Peloponnese no records were reported so far.

MATERIAL AND METHODS

For sifting leaf litter a beetle sifter with grid width of 7 mm was used. The extraction method applied follows Germann (2014).

Photographs were taken with a 5-megapixel digital camera (Leica DFC 420), the genital organs were photographed in glycerine. Series of images were captured through a binocular (Leica MZ16) and processed by an Auto-Montage software (Imagic Image Access, Version 8). The drawings by Olena Domschke were made using a camera lucida attached to a stereomicroscope (Olympus BH-2).

All measurements were taken digitally with the measurement-tool of the above mentioned Auto-Montage software. Body length was measured from the base of the rostrum to the apex of the elytra. Additional remarks to label data are set in square brackets ([]).

Abbreviations: NHML – The Natural History Museum, London. MHNG – Muséum d'histoire naturelle de Genève, Switzerland. NMBE – Naturhistorisches Museum der Burgergemeinde Bern. cCG – collection Christoph Germann, Thun. cHW – collection Herbert Winkelmann, Berlin.

TAXONOMIC PART

Genus *Styphlidius* Penecke, 1936

Type species: *Adexius corcyreus* Reitter, 1884.

Remark: The examination of specimens of all taxa of *Styphlidius* (Figs 1-9) except *S. globosus* [depicted

in turn in Osella (1981)] allowed raising *brevisetis* and *globosus* to species level based on the morphological differences given in the key below. Furthermore a new fifth species of the genus is described below.

Additional localities used to draw the map (Fig. 20) were taken from Osella (1981), Osella & Zuppa (1994) and Bahr *et al.* (2015).

Species included:

- S. coryreus* (Reitter, 1884): Greece (Corfu, mainland), Albania (data given below)
- S. italicus* Osella, 1981: Italy (incl. Sicily)
- S. brevisetis* Osella, 1981: Greece (Kephallinia)
- S. globosus* Osella, 1981: Greece (Levkas)
- S. pelops* sp. nov.: Greece (Peloponnese)

Styphlidius coryreus (Reitter, 1884)

Figs 7-9, 12

Material examined: 1 ♀ Reza e kanalit, Logara, Alban. M., lg. Winkler Mai 1931, coll. O. Voříšek (NHML). Remark: first record for Albania. – 1 ♀, Gr. Igoumenitsa, Restori, 300 m [a.s.l.], 1.9.[19]94, Paganion-Meregalli, coll. O. Voříšek (NHML). – 1 ♂, 1 ♀, GREECE, Maked., 34 km NE Kilkis, Ano Poroia, 500 m, 41°17'26"N, 23°01'55"E, 13.7.2003, leg. Bayer (cHW).

Styphlidius italicus Osella, 1981

Figs 1-2, 10

Material examined: 1 ♀, Roma, Reitter, coll. G.A.K. Marshall (NHML). – 2 ♂, 2 ♀, I, Calabria (RC), P.N. dell' Aspromonte, 4 km SE Gambarie, 1700 m [a.s.l.], 22.10.2002, 38°08'49"N 15°51'40"E, [sifting] *Fagus*, leg. C. Germann (cCG, NMBe). – 1 ♀, I, Calabria (RC), P.N. dell' Aspromonte, 8 km SE Gambarie,

1350 m [a.s.l.], 22.10.2002, 38°07'26" 15°54'09"E, Felswand, *Fagus* [sifting near rock face], leg. C. Germann (NMBe).

Styphlidius brevisetis Osella, 1981

Figs 3-4, 11

Material examined: 2 ♂, 2 ♀, Kephallinia, [leg.] Moczarski, coll. G.A.K. Marshall (NHML).

Styphlidius pelops sp. nov.

Figs 5-6, 13-20

Holotype: 1 ♂, 242_14.6 [collection number] GREECE, Peloponnese, E Tripoli, W Agias Sofia, Pass, 800 m [a.s.l.], 24.9.2014, leg. C. Germann. Red label: Holotype *Styphlidius pelops* sp. nov. des. C. Germann 2014 (NMBe).

Paratypes: 8 ♂, 4 ♀, same data as for holotype. – 1 ♂, 242_14.10 [collection number] GREECE, Peloponnese, S Pilos, Mesohori, GS [sifted in] Buschwald [low forest, bushes], 25.9.2014, leg. C. Germann. All with additional red labels: Paratype *Styphlidius pelops* sp. nov. des. C. Germann 2014 (cCG, cHW, NMBe, MHNG, NHML).

Description

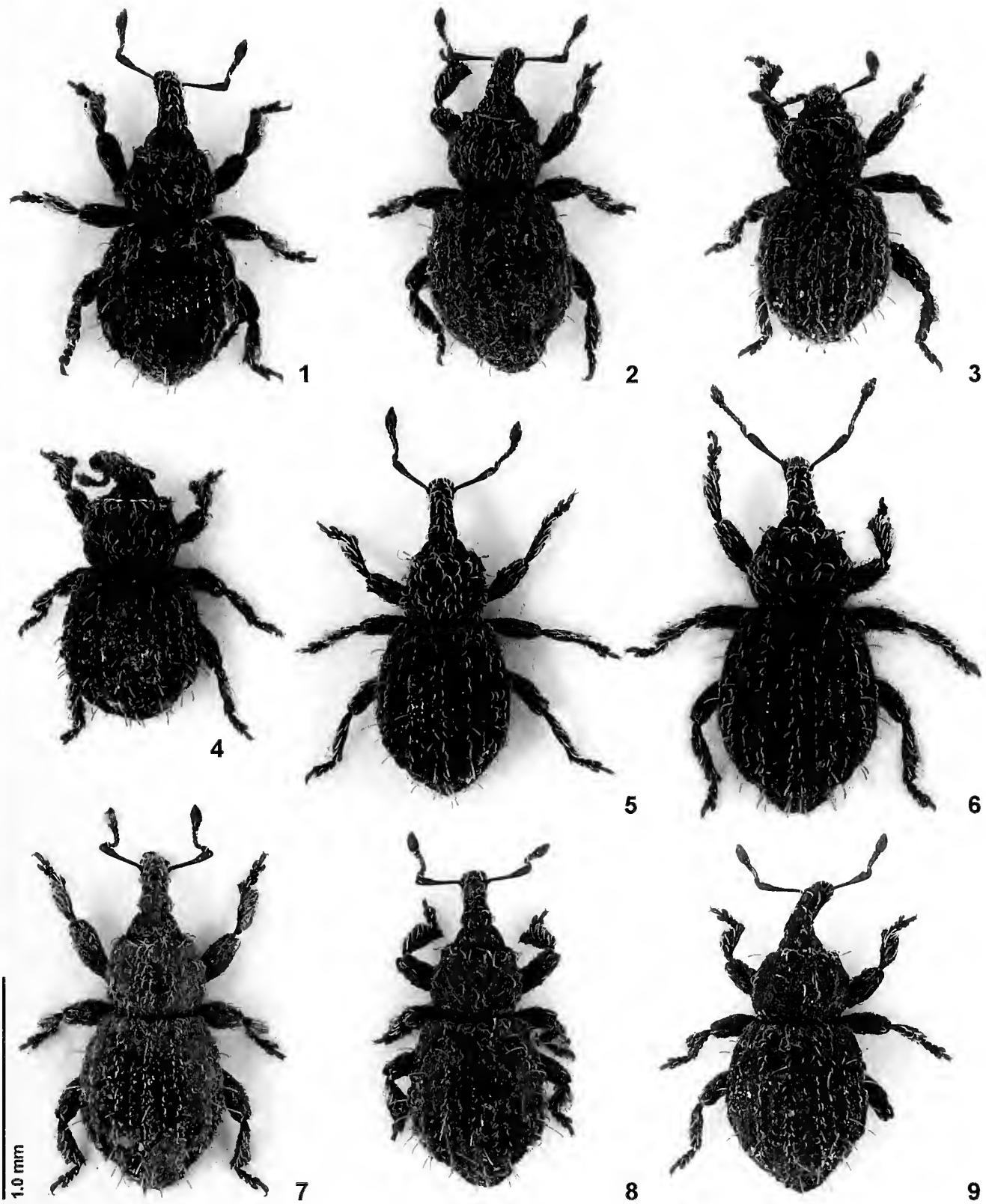
Size: males: 1.7-1.8 mm; females: 1.7-2.0 mm

Colour: auburn, tip of rostrum and partly antennal club darkened.

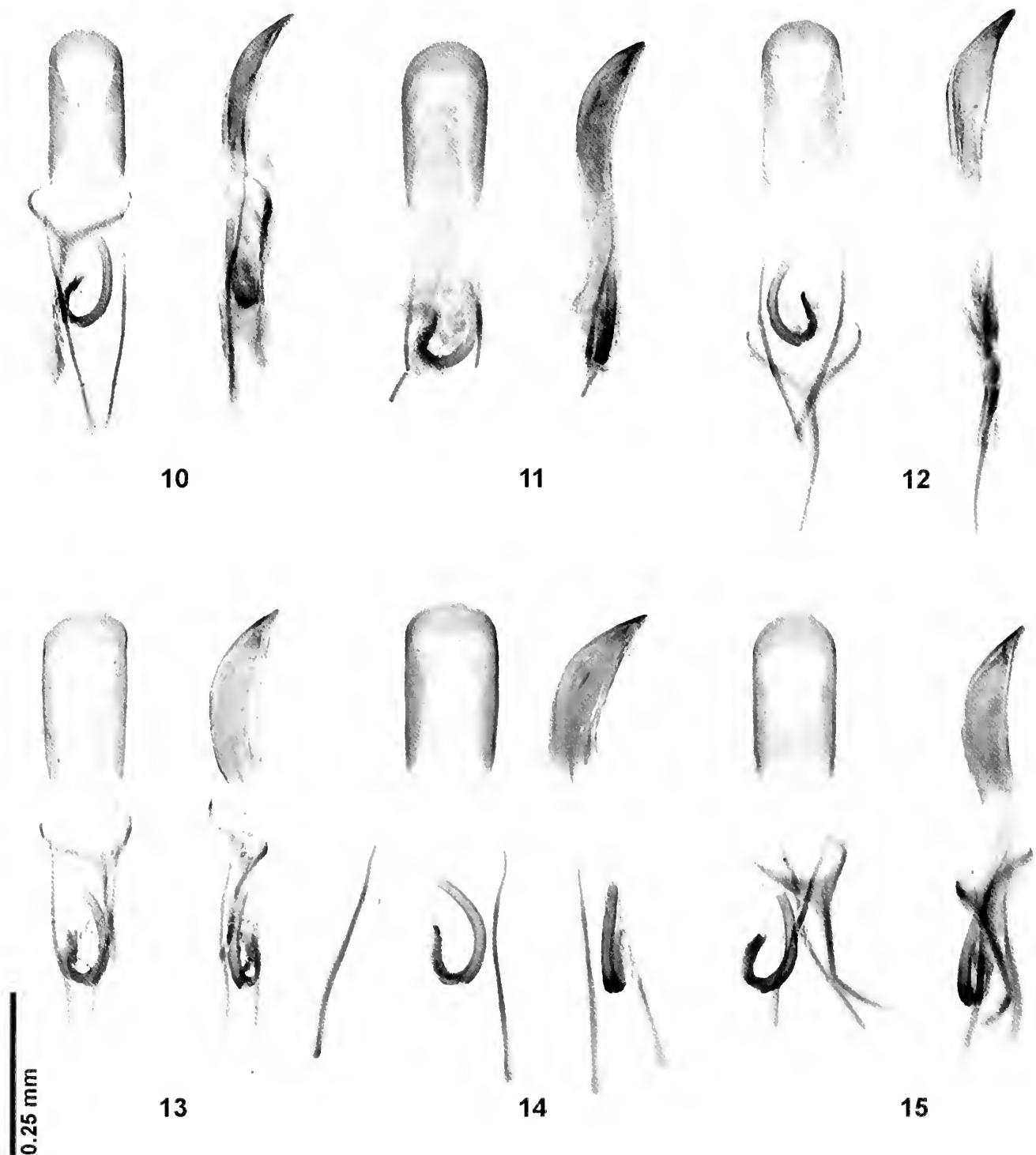
Head, rostrum and antennae: head globular, rostrum well separated from frons by a transverse impression, therefore base of rostrum angular. Rostrum in lateral view strongly curved, in dorsal view weakly converging to insertion of antennae, from there diverging towards tip. Rostrum about 4 times longer than wide, surface striated. Eyes below level of rostral dorsum, oval, weakly

Identification key for the genus *Styphlidius*:

- | | | |
|---|--|------------------------------------|
| 1 | Shape of elytra globose. Pronotum big and broad (Figs 3-4)..... | 2 |
| - | Shape of elytra either rhomboidal or oval to oblong-oval. Pronotum smaller and less broad | 3 |
| 2 | Uneven intervals on elytra with very long, weakly bowed bristles (at least as long as the span from first to third interval). Penis narrow with pointed apex (fig. 4 in Osella, 1981)..... | <i>S. globosus</i> Osella, 1981 |
| - | Uneven intervals with shorter, straight bristles (much shorter than the span from the first to the third interval). Penis with strongly sclerotized margin and oblong oval shape (Fig. 11)..... | <i>S. brevisetis</i> Osella, 1981 |
| 3 | Shape of elytra rhomboidal, broadest behind last third (Figs 5 & 6), uneven intervals stronger elevated than even ones, striae and intervals less dense standing. Penis broad and parallel sided to slightly diverging towards tip in dorsal view, broad in lateral view (Figs 13-15)..... | <i>S. pelops</i> sp. nov. |
| - | Shape of elytra oval to oblong oval, broadest in or just behind middle (Figs 1-2, 7-9), uneven intervals only slightly stronger elevated than even ones, striae and intervals denser standing..... | 4 |
| 4 | Uneven intervals on elytra with very long and raised bristles (at least as long as the span from first to third interval). Penis as Fig. 12..... | <i>S. coryreus</i> (Reitter, 1884) |
| - | Uneven intervals with shorter bristles (shorter than the span from the first to the third interval). Penis as Fig. 10 | <i>S. italicus</i> Osella, 1981 |

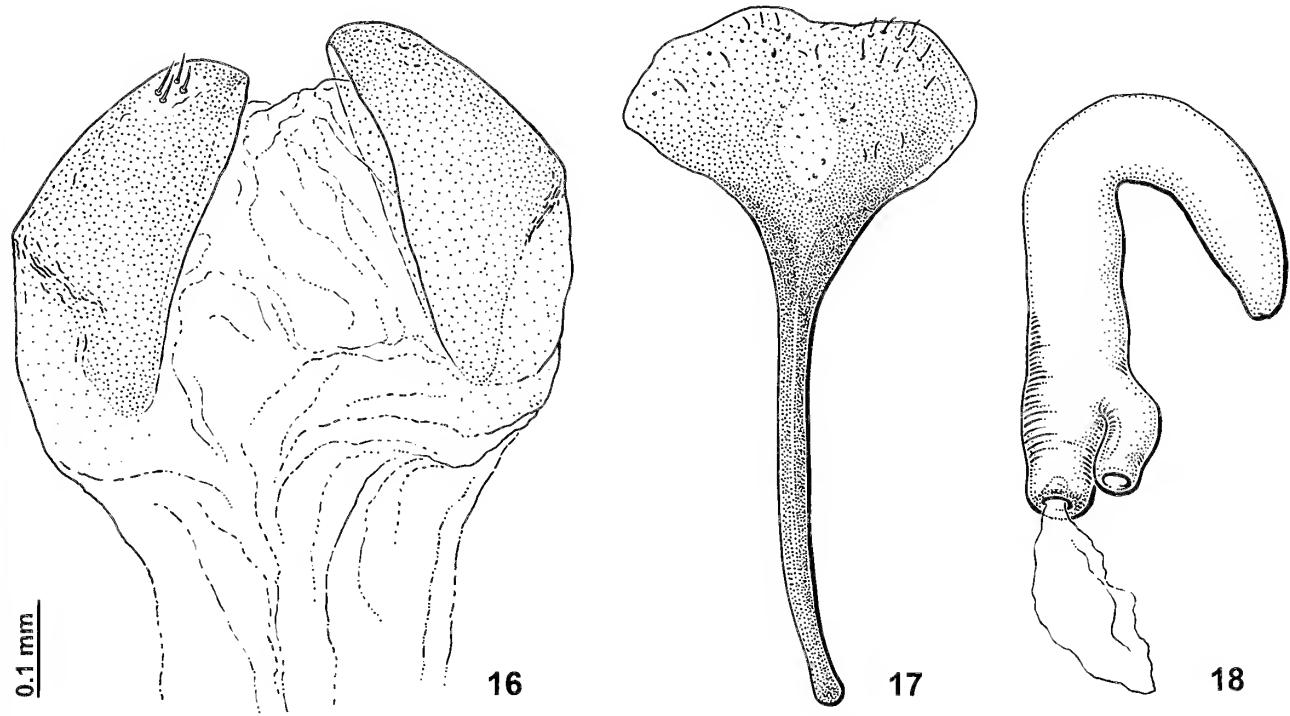


Figs 1-9. Habitus of *Styphlidius* spp. (1) *S. italicus* Osella, 1981 (Aspromonte, male). (2) Ditto (female). (3) *S. brevisetis* Osella, 1981 (Kefalonia, male). (4) Ditto (female). (5) *S. pelops* sp. nov. (Mesohori, male). (6) Ditto (W Agias Sofia, female). (7) *S. corcyreus* (Reitter, 1884) (Kilkis, male). (8) Ditto (Igoumenitsa, female). (9) Ditto (Reza e kalalit, female).



Figs 10-15. Penis dorsal and lateral of *Styphlidius* spp. (10) *S. italicus* Osella, 1981 (Aspromonte). (11) *S. brevisetis* Osella, 1981 (Kefalonia). (12) *S. corcyreus* (Reitter, 1884) (Kilkis). (13-15) *S. pelops* sp. nov. (13 Mesohori, 14-15 W Agias Sofia).

Fig. 19. Habitat of *Styphlidius pelops* sp. nov. near Agias Sofia. The new species was sifted here from leaf litter (*Quercus ilex*) and mosses growing on limestone. ➔



Figs 16-18. Female genital organs of *S. pelops* sp. nov. (16) Gonocoxite. (17) Spiculum ventrale. (18) Spermatheca.



bulged. Antennae inserted before last fourth of rostrum, scrobes lateral, well pronounced, diverging towards the eyes. Antennal scape clubbed, nearly 3 times as long as breadth of rostral dorsum at antennal insertion. Antennal funiculus consisting of 7 segments with following measurements (length/width): 1st: 1.77; 2nd: 1.23; 3rd to 5th: globular, as long as wide; 6th and 7th: transverse: 0.51 and 0.53. Club twice as wide as last segment, short oval. Integument: Frons and rostrum with thin, strong, bowed light brown bristles; similar but smaller bristles on antennal scape and funiculus.

Pronotum: transverse (length/width: 0.78-0.87), widest just behind its middle, constricted towards fore and hind margins, irregularly and very coarsely punctuate. Integument consisting of thin, strong, bowed light brown bristles. Scutellum hardly visible, punctiform.

Elytra: rhomboidal (length/width: 1.2-1.3), diverging from base to last third, then strongly rounded to the apex. No shoulders, apterous. In lateral view regularly rounded at decline. Striae coarsely and deeply, regularly punctuate. Intervals thin and elevated, uneven intervals 3, 5 and 7 more elevated. Intervals set with short bowed bristles, and long (almost reaching from one uneven interval to another) raised, light brown bristles.

Legs: femora edentate, strong, tibiae strong, flattened, all with thorn at inner angle of apex. Three visible strong tarsal segments; first one twice as long as second; third bilobed, about equal as first. Claw segment gracile, claws simple. Integument consisting of thin, strong, bowed light brown bristles.

Male genitalia: Figs 13-15. Penis broad, in dorsal or ventral view laterally parallel or slightly diverging towards apex, internal sac with one fishhook-shaped sclerite.

Female genitalia: Figs 16-18. Gonocoxite very simple, with one sclerotized pair of segments, without styli, apex lateral with a tiny tuft of sensillae (Fig. 16). Spiculum with short apodeme and a broad and bilobed plate (Fig. 17). Spermatheca with long, inverted J-shaped cornu, straight nodulus and short ramus (Fig. 18).

Etymology: The species name is a noun in apposition and refers to the hero Pelops, son of Tantalus in the ancient Greek mythology. The Peloponnese, where *Styphlidius pelops* sp. nov. was discovered, is named in honour of Pelops.

Ecology: *Styphlidius pelops* sp. nov. was sifted from leaf litter and mosses on limestone rocks between sparsely standing evergreen oaks (*Quercus ilex*) and *Phrygana* vegetation (mainly *Phlomis*, *Thymus*) at 800 m a.s.l. (E Tripoli) (Fig. 19) and once at 200 m a.s.l. (Mesochori). *S. pelops* sp. nov. was sifted together with the following species of Curculionidae: *Acallocrates denticollis* (Germar, 1824), *Echinoder a brachata* Wolf, 2002, and *Stomodes letzneri* Reitter, 1889.

Remarks: The gonocoxite is remarkably simple. But the comparison with one of *Orthochaetes setiger* (Beck, 1817), a widespread and quite common species in Central Europe, showed that they look very similar, apart from the tuft of sensillae which is bigger and the generally longer and more numerous sensillae in this latter species.

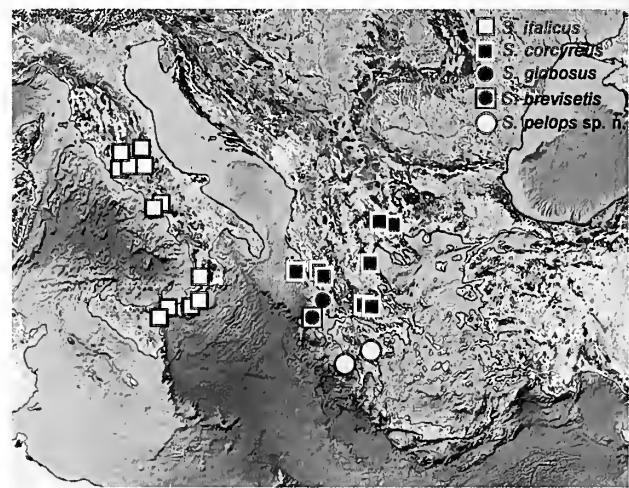


Fig. 20. Map showing known records of all species of *Styphlidius* from specimens examined and literature (Copyright 2014 Google).

ACKNOWLEDGEMENTS

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Shedding more light on historical hypothetical records of some Paraguayan birds listed by A. de W. Bertoni

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Abstract: The “Catálogos Sistemáticos de los Vertebrados del Paraguay”, published in two editions by Arnaldo de Winkelried Bertoni (1878-1973) during the early decades of the 20th Century, represented one of the first attempts to collate in a single work the available information about Paraguayan birds. However various species listed in these works have been the subject of much debate by subsequent authors. In this paper we review the historical reports of 14 such species cited by Bertoni that were treated in later works as hypothetical, making historical reference to overlooked literature from the period and suggesting new status designations for each.

Keywords: Berlepsch - Catálogos Sistemáticos - distribution - Puerto Bertoni - status - MHNG specimen.

INTRODUCTION

Following in the great tradition of Paraguayan-based naturalists began by Félix de Azara, Arnaldo de Winkelried Bertoni (1878-1973) was the principal student of the national fauna during the early 20th Century. Working under geographical and logistical constraints from his base at the family estate Puerto Bertoni ($25^{\circ}38'60''S$, $54^{\circ}34'60''W$) and later in the capital Asunción, his major contributions were his “Catálogos Sistemáticos” of the Paraguayan vertebrate fauna which was published in two editions, an initial attempt in 1914, and a revised and updated version in 1939. Bertoni (1914, 1939) however employed a confusing and often inconsistent approach to referencing, distribution and listing which is easily misinterpreted.

Though Bertoni was an avid collector of specimens his Catálogos unfortunately do not make specific reference to them (though in many cases voucher specimens undoubtedly existed to support the records). The vast majority of his collections were subsequently lost, making it impossible to confirm in some cases which species were documented with specimens and which were based on

his field observations or those of others. The few remnants of his collections that have survived in Paraguay (mostly mammalian) are housed in a small museum at the Puerto Bertoni monument. As a result several species which Bertoni listed and for which no further records have been forthcoming have been more recently treated as “hypothetical” (Hayes, 1995; Guyra Paraguay, 2004). Two major recent critical reviews of the Paraguayan avifauna (Hayes, 1995; Guyra Paraguay, 2004) classified hypothetical species into a series of hierarchical categories reflecting different problems with records. The latest review (Guyra Paraguay, 2004) included 66 species in this category, with 33 considered “possible” and 30 considered “doubtful”, plus an additional 38 species that were “not evaluated” and 12 classed as “erroneously cited”. Several of these species have since been transferred to other categories (Smith & Ríos Díaz, 2014a, b; Smith *et al.*, 2014a), including some species that have been officially documented (Smith & del Castillo, 2006; Lesterhuis & Clay, 2011; Álvarez *et al.*, 2012, del Castillo, 2013; Smith *et al.*, 2014c), but questions still remain about some other species.

MATERIALS AND METHODS

The bibliographical history of reports of fourteen hypothetical species that were listed by or attributed to Bertoni (1914, 1939) are thus investigated. Museum specimens were examined or looked for in several institutions, listed below. Additional information is provided where available and new recommendations for their designations are made where necessary.

Abbreviations

AMNH	American Museum of Natural History, New York, U.S.A.
FMNH	Field Museum of Natural History, Chicago, U.S.A.
MHNG	Muséum d'histoire naturelle de Genève, Switzerland
NHMW	Naturhistorisches Museum Wien, Austria

RESULTS

Tigrisoma fasciatum (Such, 1825) Fasciated Tiger Heron

Hayes (1995) notes that Bertoni (1901) reported “*Tigrisoma (marmoratum?)*” (=*Tigrisoma lineatum*) for “Monda-ih” (=Río Monday, Departamento Alto Paraná), but that the immature specimen described was later re-identified as *T. fasciatum* (Such, 1825) by Lynch Arribálzaga (1902) on the basis of white streaks on the tail and lower back. However, members of this genus go through a complex series of ontogenetic changes and white streaking is not considered diagnostic. The safest way to distinguish between the two species in immature plumage is bill morphology (Hancock & Kushlan, 1984). Bertoni (1918b) listed *T. fasciatum* but included a footnote in which he stated that “perhaps, as Ihering and I thought, it is just a form of *T. marmoratum*”. Presumably for this reason he retained it as doubtful in Paraguay in both of his Catálogos (Bertoni, 1914, 1939). Laubmann (1939) treated this species in his synonymy of *T. lineatum marmoratum*.

More recently Meisel *et al.* (1992) list the species without details for Reserva Natural del Bosque Mbaracayú, Departamento Canindeyú but it has been omitted from all subsequent lists for the locality (eg, Fariña & Hostettler, 2003; Mazar Barnett & Madroño, 2003) and *Tigrisoma lineatum* is regularly encountered there. Additionally López (1994) included a sight record of two individuals at Estero Doña Cinthia, Departamento Presidente Hayes in July 1993 but these were then omitted from the summary table.

Guyra Paraguay (2004) cast doubt on these sight records but treated the species as “possible” on the basis of a specimen identified as this species in MHNG. Though they were unable to examine the specimen, they considered that it was probably misidentified based on the

unlikely locality of “km293 Ruta Trans Chaco” (Departamento Presidente Hayes). We were able to trace this immature specimen (MHNG 1720.070) collected by Dlouhy and Weber on 5 July 1985 and confirm from the straight culmen and slender bill that it is referable to *Tigrisoma lineatum*.

Given the potential for and history of confusion with immature *Tigrisoma lineatum*, undocumented sight records of *T. fasciatum* cannot be considered acceptable. We recommend that this species be removed from the list of “possible” species in Paraguay and considered “erroneously cited”. However we note that records in Brazil are suggestive of potential occurrence in Paraguay.

Charadrius falklandicus Latham, 1790 Two-banded Plover

Listed as possible by Hayes (1995) and Guyra Paraguay (2004). Hayes (1995) states that Bertoni (1914) cites the species based on Ihering, “but the record is too far out of range to be credible”. Guyra Paraguay (2004) add that they can find no mention of the species in Ihering (1904), but this is a misunderstanding as the citation to which Bertoni refers is actually Ihering & Ihering (1907: 49) where Paraguay is indeed listed in the species range but without any specific details. However one of the main sources for Ihering & Ihering (1907) was Sharpe (1896) and though Paraguay is omitted from the main distribution section, it is listed in the cited texts as “Berlepsch, J. f. O. 1887, p. 134 (Paraguay)”. Berlepsch (1887) included the species with a query (?) only in his addenda of possible species.

We agree with Hayes (1995) that the record is unlikely to be credible but disagree with Berlepsch’s (1887) assumption about the possible distribution of this species. The certainty given to this speculative listing by subsequent authors is at the root of all subsequent citations and thus we recommend that this species be treated as “erroneously cited” in Paraguay.

Aratinga auricapilla (Kuhl, 1820) Golden-capped Parakeet

Hayes (1995) considered the species “possible” on the basis of a poorly described record of a pair from Puerto Bertoni on 11 November 1918, of which the female was collected (Bertoni, 1918a). As Hayes (1995) correctly points out the measurements provided by Bertoni (1918a) (Length 305 mm; Wing 162 mm; Tail 140 mm) are indeed consistent with this highly distinctive species (Juniper & Parr, 1998), which is unlikely to be confused in the hand with any other regionally occurring psittacid.

Hayes (1995) notes that numerous specimens were taken in eastern Paraná between 1901 and 1929 (Oliveira Pinto, 1938; Collar *et al.*, 1992), but his grounds for sug-

gesting that the “origin of the birds may be questionable (i.e. escaped cagebirds)” seem entirely speculative. Furthermore Bertoni (1918a) notes that the year the specimen was taken was “abnormal due to the lack of fruit caused by cold”, conditions which might be considered consistent with natural vagrancy. Regardless of the poor description provided, we find no convincing reason to question Bertoni’s (1918a) identification. Though habitat loss and an alarming range reduction suggest that the re-appearance of the species in Paraguay may be extremely unlikely, we recommend that it be treated as “pending documentation”.

***Pyrrhura perlata* (Spix, 1824)** **Pearly Parakeet**

Bertoni (1939) reports “*Pyrrhura perlata australis* Todd.” from “Pinasco, Chaco” (=Puerto Pinaseo, Departamento Presidente Hayes). Hayes (1995) considered the record doubtful adding that “if correctly identified the record undoubtedly represents escaped cagebirds or were imported from elsewhere”. In fact *australis* Todd, 1915 is a subspecies of Green-cheeked Parakeet *Pyrrhura molinae* Massena & Souancé, 1854 (Juniper & Parr, 1998) and not Pearly Parakeet *P. perlata*, and Puerto Pinasco is well within the known distribution of that species in Paraguay (Guyra Paraguay, 2005). As a result *P. perlata* should be added to the list of “erroneously cited” species.

***Sappho sparganura* (Shaw, 1812)** **Red-tailed Comet**

Hayes (1995) notes the existence of a specimen (FMNH 46377) labeled “Paraguay” with the collectors name “White”, and correctly states that nobody of that name ever collected birds in Paraguay. This certainly refers to Ernest William White (1858-1884) an English collector, traveler and naturalist who worked extensively in Argentina until his untimely death (White, 1881; M. Pearman, in litt.) and is presumably also the “Paraguay” specimen that was examined by Cory (1918) without further comment. White (1881) mentions visiting certain Paraguayan ports on the Paraná River during a visit to Provincia Misiones in northern Argentina, but does not make reference to any collecting activity. White (1882) documents the collection of a male and a female of this species at the “City of Catamarca” on 12 August 1880, but states that the species occurs “somewhat sparsely over the upper provinces of the Republic”. If collected by White this specimen likely came from Argentina and not Paraguay.

Zotta (1937) includes “S. Paraguay” in the distribution of the species and Bertoni (1939) lists *Sappho sappho* (sic) with locality “S. W. Paraguay S. O. P.” The initials S.O.P.

refer to Sociedad Ornitológica del Plata, presumably in direct reference to Zotta (1937), however it is unclear why Bertoni added “S. W.” to the distribution given in that work. The basis of the change may be related to a brief letter published in Ibis (Sclater, 1893) in which it is suggested that the species “should probably be added” to the Paraguayan avifauna because of its occurrence in “Northern Argentina”. Regardless the lack of clarity and specific details means that the species should best be retained as “possible” pending further data.

***Celeus torquatus* (Boddaert, 1783)** **Ringed Woodpecker**

Listed as a “doubtful” species by Hayes (1995) and “not evaluated” by Guyra Paraguay (2004). Hayes (1995) gives the source as Bertoni (1914: 49) who cites “*Cerchneipicus tinnunculus* (Wagl.)” but without locality. In fact, the source for this is also Ihering & Ihering (1907) who list the range of *C. tinnunculus* as “Paraguay, Matto Grosso e Amazônia, Pará, Rio Negro, Bahía” and of *C. torquatus* as “Rio Negro, Amazônia inf., Pará, Pernambuco, Guyana e Venezuela”. These two forms were subsequently synonymized under *Celeus torquatus* (Peters, 1964).

However the distribution provided by Ihering & Ihering (1907) is highly inaccurate according to current knowledge (Winkler et al., 1995) and one of the principal references of that work was Hargitt (1890) who described the distribution of *C. tinnunculus* as “Eastern Brazil (Bahía), and westward in Matto Grosso to the Paraguay and Guaporé Rivers”. We suspect that this may have then been over-extrapolated to include Paraguay and thus we agree with Hayes (1995) that this species should be considered “doubtful”.

***Myiothlypis leucophrys* (Pelzeln, 1868)** **White-striped Warbler**

Hayes (1995) lists this species as “doubtful” stating that the species was “reported at Río Paraná (Bertoni, 1939: 23), perhaps referring to records farther north in Brazil”. Guyra Paraguay (2004) follow the same course without additional comment. In fact the deployment of a different font for this species by Bertoni (1914, 1939) implies that the species had not been reported in Paraguay but was of potential occurrence. The locality cited by Bertoni (1914, 1939) “Río Paraná, S.P., Goyas, (Bras.)” repeats Ihering & Ihering (1907) who gave an identical distribution for the species in Brazil. Consequently this species has never been claimed to occur in Paraguay and we recommend that it be added to the list of “erroneously cited species”.

***Paroaria gularis* (Linnaeus, 1766)**
Red-capped Cardinal

Bertoni (1914, 1939) listed this species without locality data presumably on the basis of a specimen reported by Salvadori (1895) from “Porto Pagani, Río Apa” collected sometime between August and November 1893. However Salvadori (1895) states that the specimen had a yellow bill, prompting Hayes (1995) to consider the record doubtful as the description “clearly refers to the Yellow-billed Cardinal *P. capitata*”. Earlier however Hellmayr (1938) had included it in the synonymy of *P. capitata* (d’Orbigny & Lafresnaye, 1837) after examining the specimen in the Turin museum, and had rebuked Bertoni for including it in the Paraguayan avifauna “evidently without having seen a specimen”. As a result this species should be added to the list of “erroneously cited species”.

***Turdus ignobilis* Selater, 1858**
Black-billed Thrush

Listed as “doubtful” by Hayes (1995) and Guyra Paraguay (2004), the former stated that this species was “reported at N.W. Chaco?” by Bertoni (1939:34). However Bertoni (1914, 1939) makes no mention of *Turdus ignobilis*, though both list “*Turdus phaeopygus* Cab.” as hypothetical (indicated by the employment of a different font in each case). Bertoni (1939) gives the locality for *T. phaeopygus* as “Amazonia a Venezuela, N.W. Chaco?”.

Bertoni (1907), reporting “*Merula crotopeza* (Licht.)” had earlier stated he could find no differences between the specimens of “*Merula phaespyga* [sic] (Cab.)” that he had examined in the Rio de Janeiro museum and “*M. metallophona* Bertoni”, additionally mentioning the possibility of synonymy between *phaespyga* and *crotopeza*. He then subsequently suggested that all three were conspecific (Bertoni, 1913), adding that *T. subalaris* could represent the adult male of *T. phaeopygus* Cabanis (=*Turdus albicollis phaeopygus*). However in a later publication his position changed again, stating that *Planesticus metallophonous* was referable to a “young male” of *P. subalaris* and that *P. crotopezus* and *P. phaeopygus* were distinct (Bertoni, 1928). A foot note in Bertoni (1914, 1939) notes that he was able to examine an Amazonian specimen of *T. phaeopygus* (likely the same one referred to in Bertoni, 1907) which he describes as “very difficult to separate from young *T. subalaris*; but the external primary (character of value) is somewhat longer and the rectrices are less covered by the tertials and if this is not constant it would be difficult to distinguish the two species”.

Hellmayr (1934) examined a Bertoni specimen (Museu Paulista, No. 7064. Puerto Bertoni, Sept. 15, 1906) of “the bird first described as *T. metallophonous* and later consecutively identified as *Merula crotopeza* and *Turdus phaeopygus*” and found that this was “identical with the

type of *M. subalaris*”. As a result *T. phaeopygus* of Bertoni was included in the synonymy of *Turdus subalaris* (Seебохм) by Hellmayr (1934) who also clarified that it was not the same as *Turdus phaeopygus* of Cabanis (=*Turdus albicollis phaeopygus*). Bertoni (1939) seems to have been unaware of that publication. As no apparent reference to *Turdus ignobilis* in Paraguay thus exists, its inclusion by Hayes (1995) appears to be a misunderstanding. We thus suggest that it be added to the list of “erroneously cited species”.

***Turdus fumigatus* Lichtenstein, 1823**
Cocoa Thrush

First cited for Paraguay by Bertoni (1919) and mentioned again by Bertoni (1926) as a species that had been recorded just once in his 30 years of field work. Hayes (1995) considered the species doubtful because the description of the “juvenile female is inadequate” and this position was followed by Guyra Paraguay (2004) without further comment.

Bertoni (1919) describes the single specimen of “*Planesticus fumigatus*” as being taken in August 1917 in Puerto Bertoni and that the identification “does not appear doubtful” because according to Ridgway (1907) the “first phalange of the middle toe is completely unified with the outer toe”. However Hellmayr (1934) stated that the “cohesion of the anterior toes certainly is not greater than in some other species, such as *T. leucomelas*” and that the generic separation of *Planesticus* for *T. fumigatus* and its allies is thus without foundation.

Turdus leucomelas Vieillot, 1818 is an abundant species in eastern Paraguay and the grounds for assigning this specimen to *T. fumigatus* solely using toe morphology thus appears baseless, though he may have been encouraged in this decision by Berlepsch’s (1887) inclusion of the species on a list of species of probable occurrence in Paraguay. However, given that the known distribution of that species does not closely approach Paraguay (Clement & Hathaway, 2000), there have been no subsequent records and the diagnostic character employed by Bertoni (1919) implies a serious misunderstanding, we recommend that this species be added to the list of “erroneously cited species”.

***Caryothraustes canadensis* (Linnaeus, 1766)**
Yellow-green Grosbeak

Hayes (1995) and Guyra Paraguay (2004) consider the species “doubtful”, the former stating “reported at Jejuí, presumably the Río Jejuí Guazu...” (Bertoni 1939: 37) but no details provided: if a valid record, it probably represented an escaped cagebird.” Bertoni (1925) however provides details of the observation of “several pairs” during March 1920, in bushes close to forest of the Rio Verde (23°45, 56°20), coordinates that

place the locality within Departamento San Pedro in the area of the Arroyo Verde, a few kilometres northwest of Laguna Blanca. Bertoni (1925) compares the birds to *Hemithraupis guira* (Linnaeus, 1766) in colour, and also *Gubernatrix cristatella* (= *Gubernatrix cristata* Vieillot, 1817) from which it differs by the lack of the crest.

The area from where the species is reported is within the Cerrado zone of Paraguay and quite different from the humid forest that this species prefers in its normal range, and given the lack of a specimen we consider it “doubtful”. However we note a superficial resemblance of this bird to Cinnamon Tanager *Schistochlamys ruficapillus* (Vieillot, 1817), a species that occurs sporadically in the Paraguayan Cerrado, has a preference for wet habitats in dry areas (Isler & Isler, 1999) and which perhaps could account for this record if poorly seen. Perhaps coincidentally, the first Paraguayan specimen of *S. ruficapillus* was taken during the same year on 20 June 1920 (Zapata, 2003).

Phrygilus dorsalis Cabanis, 1883 Red-backed Sierra-Finch

Contrary to the opinion of Hayes (1995), the listing of “*Myiospiza dorsalis* (Ridgw.)” without details by Bertoni (1939) and attributed to “Pereyra” is not in reference to this species but in reference to *Coturniculus manimbe* var. *dorsalis* Ridgway, 1874 (Baird *et al.*, 1874). This is a synonym of *Myiospiza humeralis xanthornus* (Darwin, 1839) [= *Ammodramus humeralis* (Bosc, 1792)] (Hellmayr, 1938). Wetmore (1926) reported “*Myiospiza humeralis dorsalis*, Paraguay (Puerto Pinasco)” also in reference to this form. The species should be added to the list of “erroneously cited species”.

Sporophila melanops (Pelzeln, 1870) Hooded Seedeater

Hayes (1995) considered the species doubtful as Bertoni (1914, 1939) listed the species as one of the members of Azara’s (1802) unidentifiable composite description of bird No. 126 (Pico grueso variable) jointly with *S. cinnamomea*, *S. nigroaurantia* and *S. pileata*. The association with Azara was probably also the reason for the locality “Asunción” given for *S. melanops* and *S. nigroaurantia* in Bertoni (1939). This highly speculative approach received a further rebuke from Hellmayr (1938) who stated that its inclusion in the Pico grueso variable “as is assumed by Bertoni... remains to be proved by the actual taking of specimens in Paraguay”. No specimens have been forthcoming and the species itself is of dubious validity, being known only from a single old specimen held at the NHMW collected by Natterer on 19 October 1823 at Porto do Rio Araguaya, Goiás, Brazil. With no concrete evidence

of the species ever having occurred in Paraguay and Bertoni’s speculation completely unfounded, it should be added to the list of “erroneously cited species”.

Sporophila albogularis Spix, 1825

White-throated Seedeater

Considered “doubtful” by Hayes (1995) on the basis of Bertoni (1914, 1939) listing the species with a query. The species was also listed for Paraguay with a query by Ihering & Ihering (1907) who followed Sharpe (1888) in citing the main range as “Bahía” (Brazil). However Bertoni cites “Oberh.” as the source of his uncertainty in reference to Oberholser (1902) who commented on a collection of birds taken by William T. Foster at “Sapucay” (= Sapucái, Departamento Paraguarí).

Oberholser’s text states that the bird is a female that “apparently belongs to this species” but provides no basis for the identification other than listing the iris colour as “brown”. However the AMNH now holds no specimens of this genus collected by Foster in Paraguay (T. Trombone in litt.). Regardless the female of *S. albogularis* possesses no obvious diagnostic characters that might confirm such an identification (Ridgely & Tudor, 1989) so far outside of the species known range and is thus almost certainly in error. The species should thus be listed as “erroneously cited”.

CONCLUDING REMARKS

Bertoni (1914, 1939) states that he had “the honour of being assisted by” the founder and director of the Museu Paulista Hermann von Ihering (1850-1930) during his visit to São Paulo in 1905, and it is clear throughout his catalogue that he placed considerable trust in his learned colleague’s judgement (Smith *et al.*, 2014b). German born Ihering had first travelled to Brazil in 1880 in order to carry out scientific exploration for the German Imperial government, being funded in part by the wealthy aristocratic ornithologist Hans Hermann Carl Ludwig von Berlepsch (1850-1915) with whom he shared close contact.

Berlepsch (1887) had earlier produced the first attempt at a list of the species of Paraguay, which included as an addendum 113 species for which “occurrence in Paraguay cannot be proven, but based on known distribution their presence can be safely assumed”. Whilst he was indeed correct in most cases, current knowledge suggests he made some errors of judgement which have since found themselves into the literature. The respect in which Bertoni held his esteemed colleagues and the network of contacts which he held with them either directly or indirectly can thus be demonstrated to have had considerable influence on Paraguayan ornithology in the early years of the 20th Century, and explains the inclusion of some of the hypothetical species dealt with herein.

Another common source of error is the incorrect association of older names with similar names in current usage for completely different taxa (Smith & Ríos Díaz, 2014b). These easily avoidable misunderstandings are caused principally by the undesirable tendency in recent ornithology to omit authors of taxa.

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A new species of Goniacerini from Cameroon (Coleoptera: Staphylinidae: Pselaphinae)

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Abstract: *Ogmocerodes navigator* sp. n. is described from Cameroon. The habitus and other morphological characters relevant to taxonomy are illustrated with colour photographs. The entire foveal pattern is also shown for the first time in an African Goniacerini.

Keywords: Goniaceritae - taxonomy - *Ogmocerodes* - new species - Afrotropics.

INTRODUCTION

Goniacerini are rather compact Pselaphinae with conspicuous, geniculate antennae. They occur in the Neotropics and in Africa south of the Sahara, and are usually collected from lowland forest leaf litter, close to or directly from decomposing wood, and several African species in association with ants or termites (Jeannel, 1959; Leleup, 1978). The most notable members of the tribe include the South African termitophile *Kistneriella termitobia* Leleup, holding the largest individual of the subfamily with a body size of 7.5 mm (Leleup, 1971, 1978), and the Neotropical genus *Heptameron* Comellini, which is one of the rare pselaphine genera in which the elytra cover the entire abdomen (Comellini, 1979).

The tribe shows an evolutionary trend towards reduction of the number of antenomeres, from eleven to five (*Paragoniates* Comellini) in the Neotropics, and from eleven to six (*Parasimus* Jeannel) in Africa. In both regions the generic concepts of Goniacerini are largely based on this feature, often in combination with the sexually dimorphic antennae, legs, as well as other male features (Comellini, 1979; Jeannel, 1949a, b, 1959; Leleup, 1978, 1982; Raffray, 1882; Schaufuss, 1872), which in our opinion should not be used to define a taxon above the specific level. In fact, the number of antennal segments in Pselaphinae sometimes vary within a genus, as evidenced notably in Goniaceritae within *Plagiophorus* Motschusky (Burckhardt & Löbl, 2002), or in other distantly-related groups such as the clavigerine genus *Colilodian* Besuchet (Löbl, 1998). Taking these facts into consideration, the current generic classification

of Goniaerini in the Neo- and Afrotropical regions is believed largely artificial and should be thoroughly revised in the future.

Some hundred individuals of African Goniacerini are represented in scientific collections, placed in forty-five species spanning sixteen genera, with eleven of them monotypic (Newton & Chandler, 1989). More than half of the known species are placed in the genera *Ogmocerodes* Jeannel (14 spp.) and *Ogmocerus* Raffray (12 spp.) – two of the fourteen genera that have eleven-segmented antennae. Separation of these two genera from each other is however based on the presence/absence of the pronotal antebasal sulcus, which shows variations in depth and length when present (i.e. in *Ogmocerodes*), and on the location/presence/absence of the modifications on male legs and antennae.

In this paper we describe a new species of *Ogmocerodes* from Cameroon, taking the rare opportunity to have eight conspecific individuals at hand to illustrate for the first time the entire foveal pattern of the tribe.

MATERIAL AND METHODS

Morphological terminology follows Chandler (2001), except our use of ‘ventrite’ instead of ‘sternite’ when describing meso- and metathoracic structures.

The following abbreviations are applied: AL–length of the abdomen along the midline; AW–maximum width of the abdomen; EL–length of the elytra along the sutural line; EW–maximum width of the elytra; HL–length of the head from the anterior clypeal margin to

the occipital constriction; HW—width of the head across eyes; PL—length of the pronotum along the midline; PW—maximum width of the pronotum. Length of the body is a combination of HL + PL + EL + AL.

The material studied was collected under the Research Permit n° 0000076/MINRESI/B00/C00/C10/nye of the Ministry of Scientific Research and Innovation of the Republic of Cameroon. It is deposited in the Muséum d'histoire naturelle de la Ville de Genève (MHNG).

TAXONOMY

Ogmocerodes navigator Cuccodoro & Zi-Wei Yin,
sp. n.
Figs 1-4

Holotype: Cameroon; ♂, labeled ‘Cameroon, Centre Region, 100 m SW of Ebogo Tourist Center <3°24'00.0"N ; 11°28'00.0"E> 04.IX.2014, alt. 650 m, leg. G. Cuccodoro, #8 sifting leaf litter in wooden canoe abandoned in flood forest on the left shore of Nyong River’ (in MHNG; accession number MHNG ENTO 00008839).

Paratypes: 5 ♂♂, 2 ♀♀, same label data as the holotype (in MHNG; accession numbers MHNG ENTO 00008840–00008846).

Differential diagnosis: *Ogmocerodes navigator* sp. n. shares markedly punctate pronotal disc with *O. raffrayi* Brauns, 1915, but the latter species lacks femoral spines in the male. The only other congener to possess metafemoral spines in the male is *O. hustaerti* Jeannel, 1949b, but it has no mesofemoral spines. The conformation of the antennal modification, and the shape of the aedeagus are also diagnostic.

Description: Male (Fig. 1). Length 4.41–4.79 mm. Head longer than wide, HL 1.00–1.09 mm, HW 0.80–0.83 mm, regularly punctate and setose on dorsal surface, with low, short frontal rostrum. Antennal tubercles slightly prominent and close, divided by a short, deep frontal sulcus; lacking frontal fovea, with deep, setose vertexal foveae (Fig. 2A); lacking postantennal notches at lateral margins; small areas just posterior to antennal tubercles glabrous, lacking setae and punctuation; antennae (Fig. 4B) with eleven antennomeres, clubs formed by enlarged antennomeres VII–XI; scapes about as long as antennomeres II–VIII combined, distinctly sinuate near base, antennomeres II–VI each transverse, successively larger, antennomeres VII and VIII (Fig. 4C) strongly modified, each greatly enlarged and strongly concave at anteromedial margin of VII and posteromedial margin of VIII, antennomeres IX and X each transverse, narrowed at apex, XI as long as IX and X combined, with truncate base and round apex; reniform eyes each composed of about

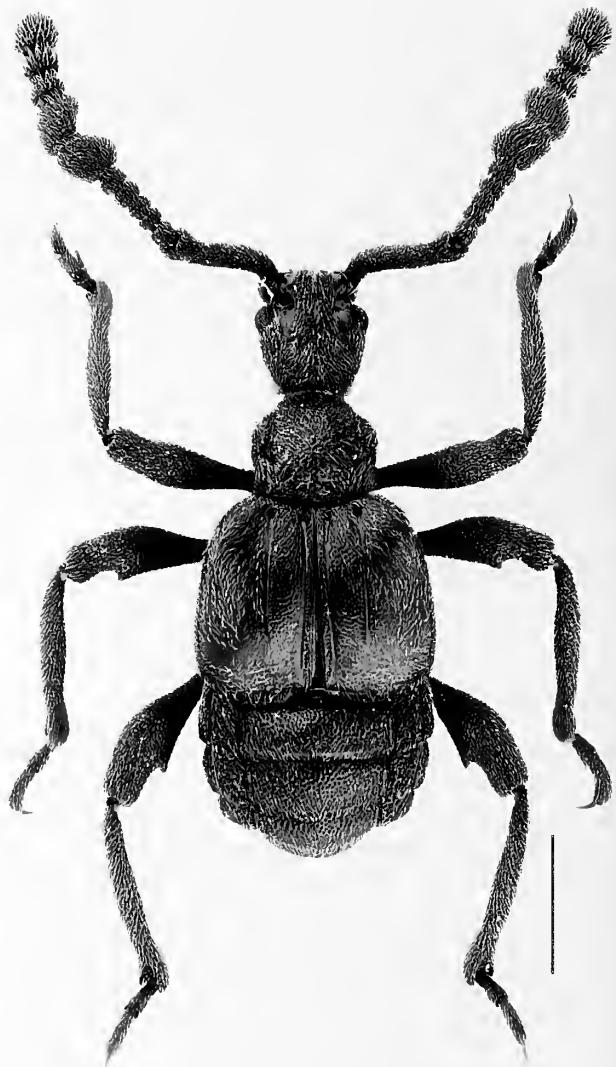


Fig. 1. Dorsal habitus of *Ogmocerodes navigator* sp. n., holotype male. Scale: 1.0 mm.

200 small facets; ocular-mandibular carinae (Fig. 2B) present; maxillary palpi with palpomere I short, II elongate, narrowed at base and widest at truncate apex, III transversely triangular, IV largest, ovoidal, with small palpal cone at apex; gula (Fig. 2C) considerably depressed posteromedially, indistinct gular sulcus present, each gular fovea has two openings, posterior pair of openings larger than anterior pair. Pronotum (Fig. 2D) about as long as wide, PL 0.85–0.91 mm, PW 0.85–0.90 mm, with slightly constricted base, regularly round margins at middle, apex constricted to form apical collar; deep antebasal sulcus connecting lateral antebasal foveae, sulcus interrupted by short longitudinal basomedian carina, with short, shallow sulcus anterior to carina; punctuation and setation of pronotal disc similar to that of head. Prosternite (Fig. 2E) with two pairs of lateral procoxal foveae; lacking paranotal sulci or carinae. Elytra (Fig. 2F) wider than long, EL 1.15–1.29 mm, EW 1.56–1.70 mm, disc more sparsely and finely punctate

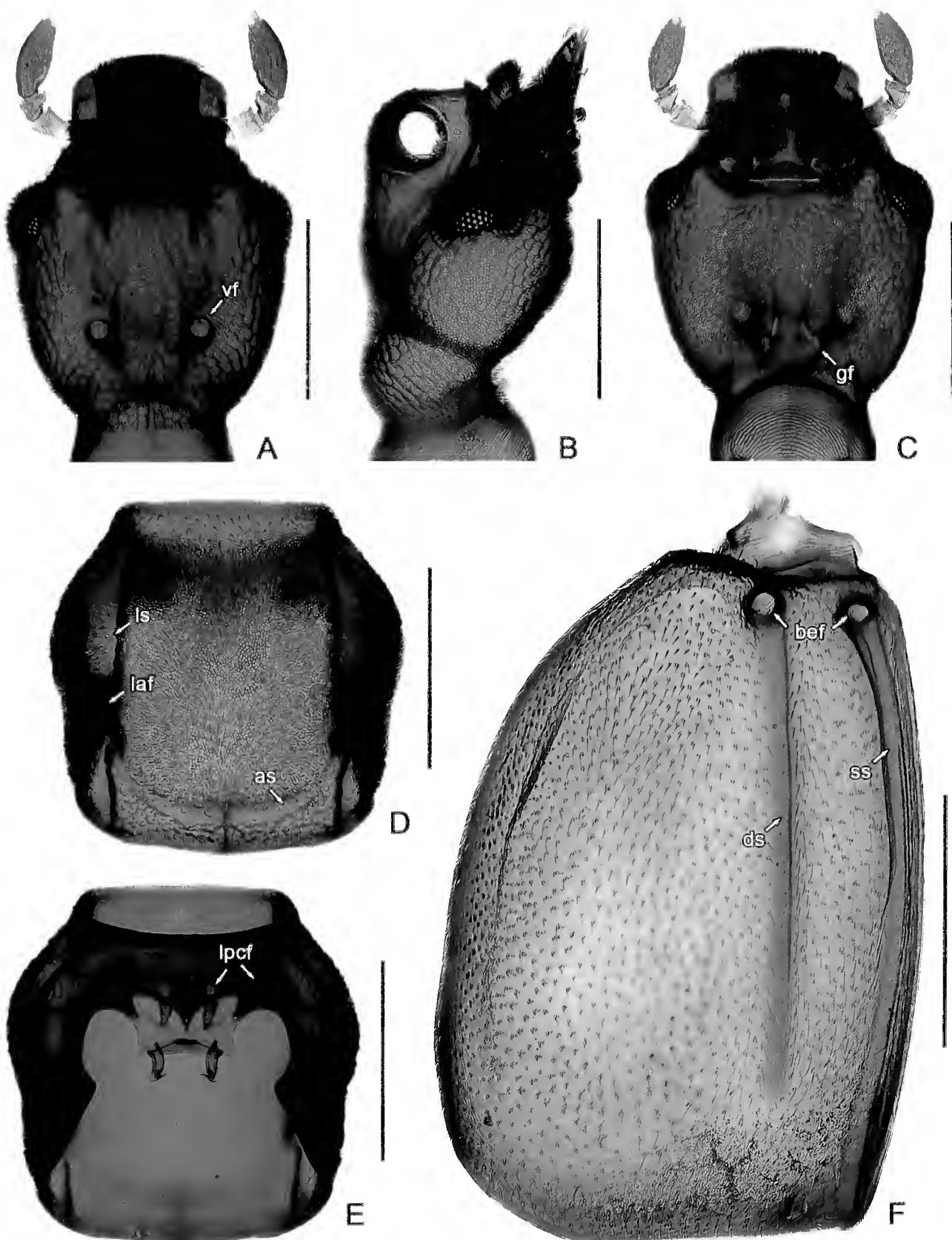


Fig. 2. Diagnostic characters of *Ogmocerodes navigator* sp. n. (A) Head, in dorsal view. (B) Same, in lateral view. (C) Same, in ventral view. (D) Pronotum. (E) Prosternite. (F) Left elytron. Scales: 0.5 mm. Abbreviations: as – antebasal sulcus, bef – basal elytral fovea, ds – discal stria, gf – gular fovea, laf – lateral antebasal fovea, lpcf – lateral procoxal fovea, ls – lateral sulcus, ss – sutural stria, vf – vertexal fovea.

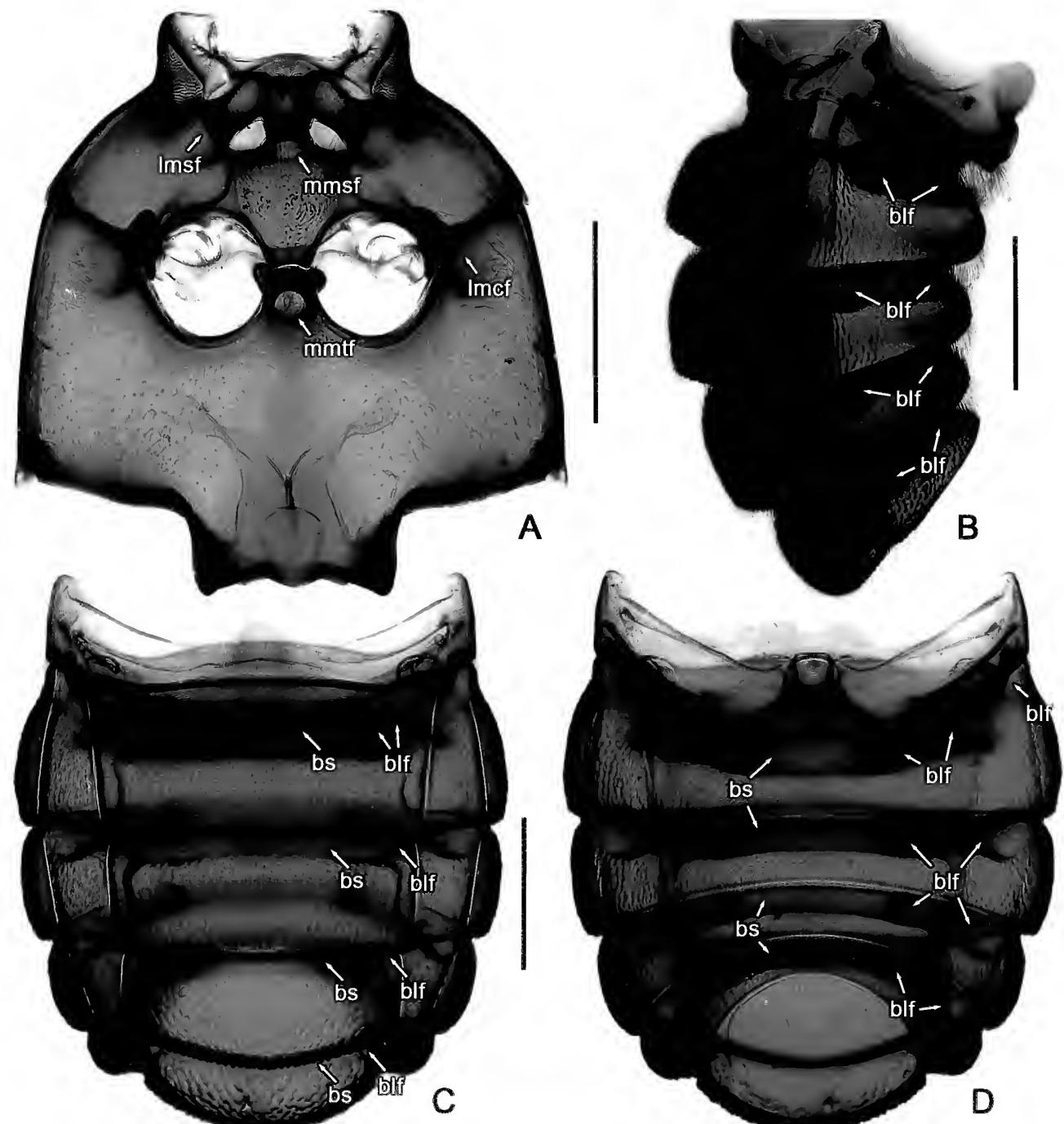


Fig. 3. Diagnostic characters of *Ogmocerodes navigator* sp. n. (A) Meso- and metaventrite. (B) Abdomen, in lateral view. (C) Same, in dorsal view. (D) Same, in ventral view. Scales: 0.5 mm. Abbreviations: blf – basolateral foveae, bs – basal sulcus, lmcf – lateral mesocoxal foveae, lmsf – lateral mesoventral foveae, mmsf – median mesoventral foveae, mmtf – median metaventral fovea.

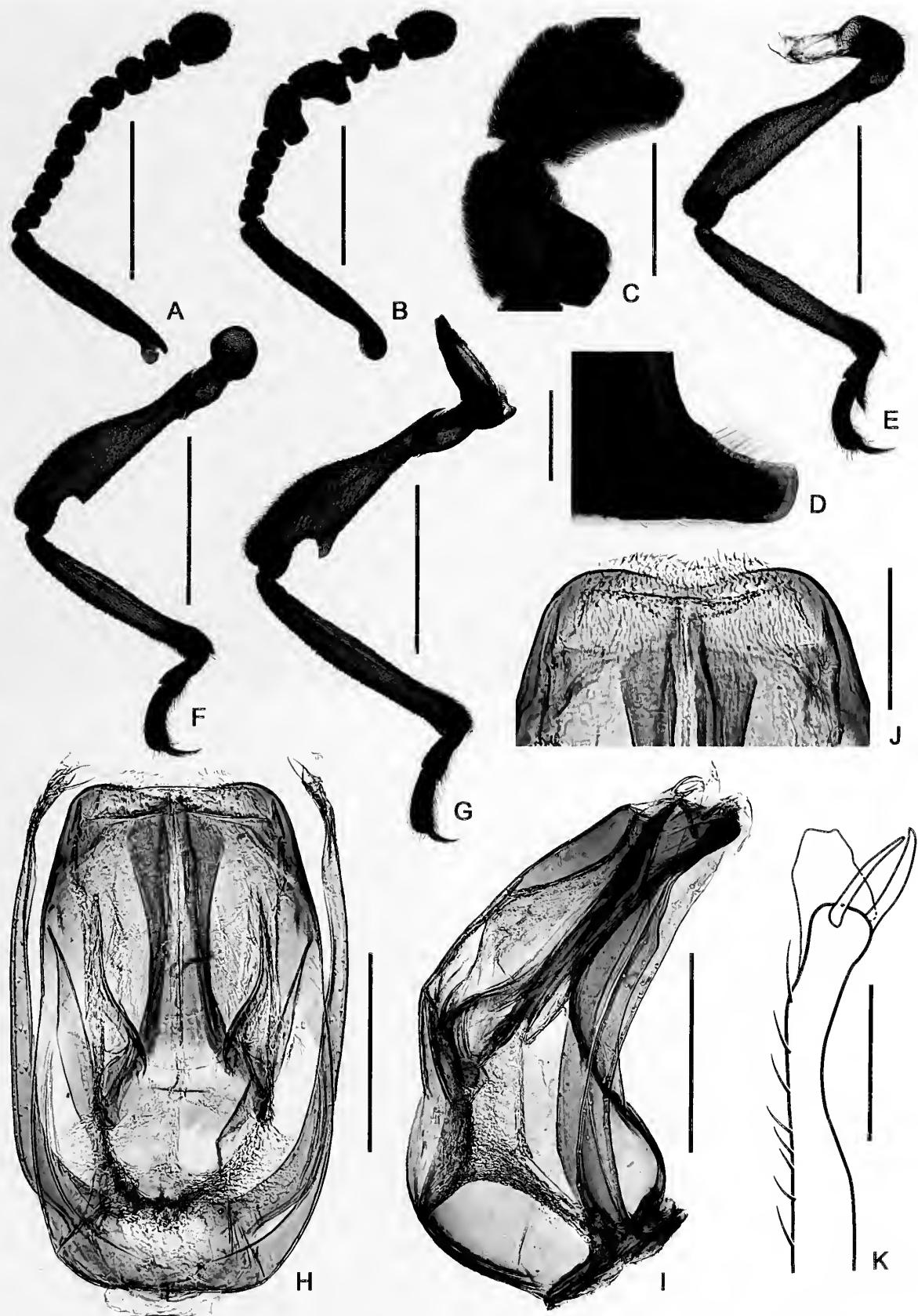


Fig. 4. Diagnostic characters of *Ogmocerodes navigator* sp. n. (A. Female. B-K. Male). (A, B) Left antenna. (C) Antennomeres VII-VIII. (D) Metaventral projection. (E) Fore leg. (F) Middle leg. (G) Hind leg. (H) Aedeagus, in dorsal view. (I) Same, in lateral view. (J) Apical portion of aedeagal median lobe, in dorsal view. (K) Apical portion of aedeagal right paramere, in dorsal view. Scales: A-C, E-G = 1.0 mm; D, H, I = 0.2 mm; J = 0.1 mm. K = 0.05 mm.



Fig. 5. Collecting site (A) and habitat (B) of the type series.

than pronotum, covered with recumbent setae; each elytron with two large, nude basal foveae; lacking subbasal fovea; sutural stria entire; discal stria extending to apical 4/5 of elytral length; lacking subhumeral foveae and marginal sulci. Mesoventrite (Fig. 3A) with single, large median mesoventral fovea, large lateral mesoventral foveae not forked; lateral mesocoxal foveae deep. Metaventre (Fig. 3A) with large median fovea slightly forked inwards; with distinct projections (Fig. 4D); posterior margin convex medially.

Legs roughly punctate, densely setose; meso- (Fig. 4F) and metafemora (Fig. 4G) each spinose at their ventral margin near apex; third tarsomeres longer than second tarsomeres, protarsomeres II (Fig. 4E) acutely lobed, extending beneath III; with single tarsal claws, and one transparent bristle-like seta.

Abdomen (Fig. 3B-D) stout, AL 1.41-1.50 mm, AW 1.57-1.66 mm, coarsely punctate, regularly setose; tergite IV (first visible tergite, Fig. 3C) slightly longer than V, lateral margins sulcate, with broad basal impression, lacking mediobasal foveae, with one large and one tiny pair of basolateral foveae in large sockets at lateral margins of impression, lacking discal carinae; tergite V as long as VI, VII much shorter than previous tergite, tergites V-VII each with basal sulcus and one pair of basolateral foveae,

and with sulcate lateral margins, tergite VIII roundly triangular, lacking fovea; paratergites accompanying tergites IV-VII (Fig. 3C). Sternite IV (second visible sternite, Fig. 3D) longest, with wide, densely setose basal sulcus, with three pairs of basolateral foveae, lateral pair smaller than mesal two pairs; sternites V-VII each with setose basal sulcus and two pairs of basolateral foveae, sternite VIII strongly transverse, lacking fovea, with broadly concaved posterior margin, sternite IX membranous, composed of lateral pair of triangular sclerites and one oval, elongate median plate.

Aedeagus (Fig. 4H, I) stout, length 0.51 mm, with symmetric median lobe and parameres, with large ovoidal dorsal diaphragm opening; anterior margin of median lobe (Fig. 4J) with membranous, finely setose fringe; parameres (Fig. 4H, I) each with rows of sparse setae from near base to apex, apex (Fig. 4K) with two large setae.

Female. Similar to male in general appearance, with simple antennomeres VII-VIII (Fig. 4A), protarsi, and meso- and metafemora, and metaventre lacking projections; each eye with about 180 facets. Measurements: BL 4.41-4.51 mm, HL 0.96-0.99 mm, HW 0.77-0.78 mm, PL 0.84-0.87 mm, PW 0.84-0.85 mm, EL 1.18-1.23 mm, EW 1.55-1.59 mm, AL 1.40-1.45 mm, AW 1.57-1.64 mm.

Habitat: The type series was collected at an elevation of 650 m just before the main rainy season, from sifted leaf litter accumulated in an old wooden canoe abandoned in a flood forest some twenty meters from the waters of the Nyong River (Fig. 5).

Distribution: The new species is known only from the type locality in central Cameroon approximately 10 km southeast of the city of Mbalmayo.

Etymology: The epithet “*navigator*” means “sailor” in Latin, remembering that the type series was collected in a canoe.

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Two new species of armoured spiders from Vietnam and Cambodia (Araneae: Tetrablemmidae: Pacullinae)

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Abstract: Two new species of paculline spiders are described on the basis of males and females: *Perania annam* sp. nov. from southern Vietnam and *Lamania bokor* sp. nov. from southern Cambodia. Both of them occur distinctly outside the previously known geographical range of each respective genus. The relationships of these species are discussed and morphological variation is illustrated. *Lamania kraui* (Shear, 1978), the closest known relative of *L. bokor* sp. nov., is re-defined on the basis of the types and of newly collected specimens from Peninsular Malaysia and Thailand. Vulva morphology in *Lamania* and scopulae in males of Tetrablemmidae are discussed.

Keywords: Taxonomy - *Perania* - *Lamania kraui* - variation - scopula - Thailand - Malaysia.

INTRODUCTION

Soon after the publication of the latest revision of the genus *Perania* Thorell, 1890 (see Schwendinger, 2013) additional congeneric specimens from Vietnam were made available by Jiří Král at the Charles University in Prague. They belong to a new species and, more surprisingly, they were collected from far outside the previously known distribution area of the genus (southern China, eastern Myanmar, Thailand, peninsular Malaysia and Sumatra; Fig. 1, hatched areas). The second new species described here belongs to the same subfamily (Pacullinae; considered a family prior to Lehtinen, 1981) but to a different genus (*Lamania* Lehtinen, 1981), and it is equally remarkable with respect to biogeography. Specimens of this species were collected in Cambodia (the first specimen was found by the second author), which is even further away from the previously known distribution area of the genus than in the case of the new *Perania* species. *Lamania* species were known from Sulawesi, Borneo and Peninsular Malaysia; the MHNG also holds material of undescribed species from the Kai Islands, East Malaysia, Lingga Archipelago, Peninsular Malaysia and southern Thailand (Fig. 1, grey areas). The new finds presented here show that the geographical ranges of both genera extend much further east into mainland Southeast Asia than previously recognized.

The new *Perania* brings the total number of species in this genus to twenty-one; the new *Lamania* raises the species count to eight. Descriptions of many more paculline species (especially in the genera *Lamania* and *Paculla*) can be expected.

MATERIAL AND METHODS

External morphology was studied and drawn with a Zeiss SV11 stereomicroscope, the vulvae (cleared in KOH and then temporarily placed in lactic acid for drawing) with a Nikon Optiphot compound microscope (both with a drawing tube). Body measurements were taken with a stereomicroscope and are given in millimetres. The total body length and the carapace length include the clypeal process, if present. The sternum length was measured between the midpoint of the anterior margin of the sternum and the posterior edge of the posterior sternal process, the sternum width between coxae II. Lengths of leg articles and palpal articles were measured on the dorsal side, from midpoint of anterior margin to midpoint of posterior margin (except for the bilobate palpal cymbium of males for which the maximal length is given), and are given in the following order: total (femur + patella + tibia + metatarsus + tarsus). The leg formula is from the shortest to the longest leg. In the legend of each

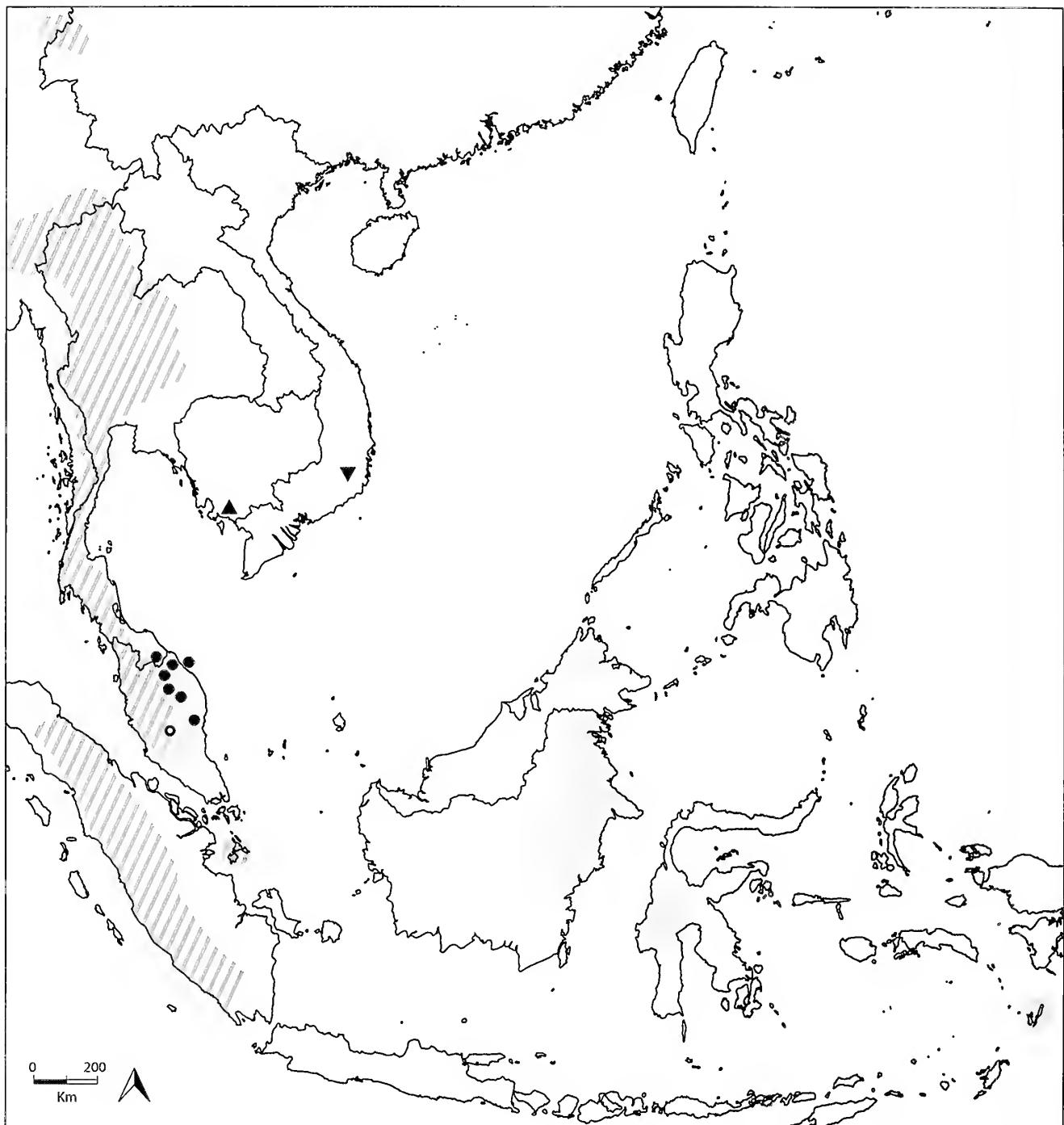


Fig. 1. Map of Southeast Asia showing localities of *Perania annam* sp. nov. (inverted triangle), *Lamania bokor* sp. nov. (triangle) and *L. kraui* Shear, 1978 (circles; empty circle indicates the type locality), and the currently known biogeographic range of the genera *Perania* (hatched areas) and *Lamania* (grey areas).

plate, references to figures that are to different scales are separated by semicolons.

The terminology follows that of Schwendinger (2013). As in *Perania* spp., the upper (dorsal) part of the bifid apex of the embolus of *Lamania* spp. is called the “subterminal lamella”, and the lower (ventral) part is called the “embolic part”.

The informal appellation “allotype” refers to the paratype on which the description of the female of each new species is based. The term “carapace” is used instead of “dorsal plate of prosoma” or “holopeltidium”. The terms “long/short”, “wide/narrow” and “deep/shallow” always relate to the longitudinal axis of the spider body, limb or palpal organ.

Setae on the palps of all species, and setae and tubercles on the carapaces of *Perania* are largely omitted in the line drawings.

Abbreviations not explained in the figure legends are: ALE = anterior lateral eyes; MHNG = Muséum d'histoire naturelle de la Ville de Genève, Switzerland; NMP = National Museum, Prague, Czech Republic; PME = posterior median eyes, PLE = posterior lateral eyes.

TAXONOMY

Perania annam sp. nov.

Figs 2-3, 8B

Holotype: MHNG; male; Vietnam, Lam Dong Province, Dalat; collector unknown, don. J. Král.

Paratypes: 1 male, 1 female (MHNG) and 1 male (NMP); same data as for holotype.

Etymology: "Annam" is the former name of southern Vietnam. Noun in apposition.

Diagnosis: The new species differs from all congeners by the presence of conically elevated hair bases on tibia II of males and on metatarsus II of females. Males

share with those of *P. egregia* Schwendinger, 2013 a very short cymbium (apex reduced) and a palpal organ with a thick embolus without marked transition between bulbous and base of embolus; *P. annam* sp. nov. males are distinguished from *P. egregia* males by the apex of the clypeal process being spade-shaped (with broadly rounded distal margin) rather than anvil-shaped (with slightly rounded or straight distal margin), by having a slightly more pronounced cymbial apex, a subterminal lamella which is pointed instead of rounded, and a longer embolic part (Figs 3A-E cf. Schwendinger, 2013: figs 9-10). The female of the new species differs from females of *P. egregia* by retaining a small preanal plate; its spermathecae have inclined instead of horizontal posterior margins; the central sclerite (pe = posterior extension of anterior collar in Fig. 3F) in the dorsal wall of the vulva is much larger and thicker, with a widely rounded posterior margin (straight in *P. egregia*) (Fig. 3F-H cf. Schwendinger, 2013: fig. 10A-E).

Description of male (holotype): Colour (in alcohol) of sclerotised parts mostly dark brown, except for lighter patellae and tibiae I-II, patella to metatarsus III and patella to tarsus IV; membranous parts of opisthosoma very light brown. Clypeus with long, distally widened

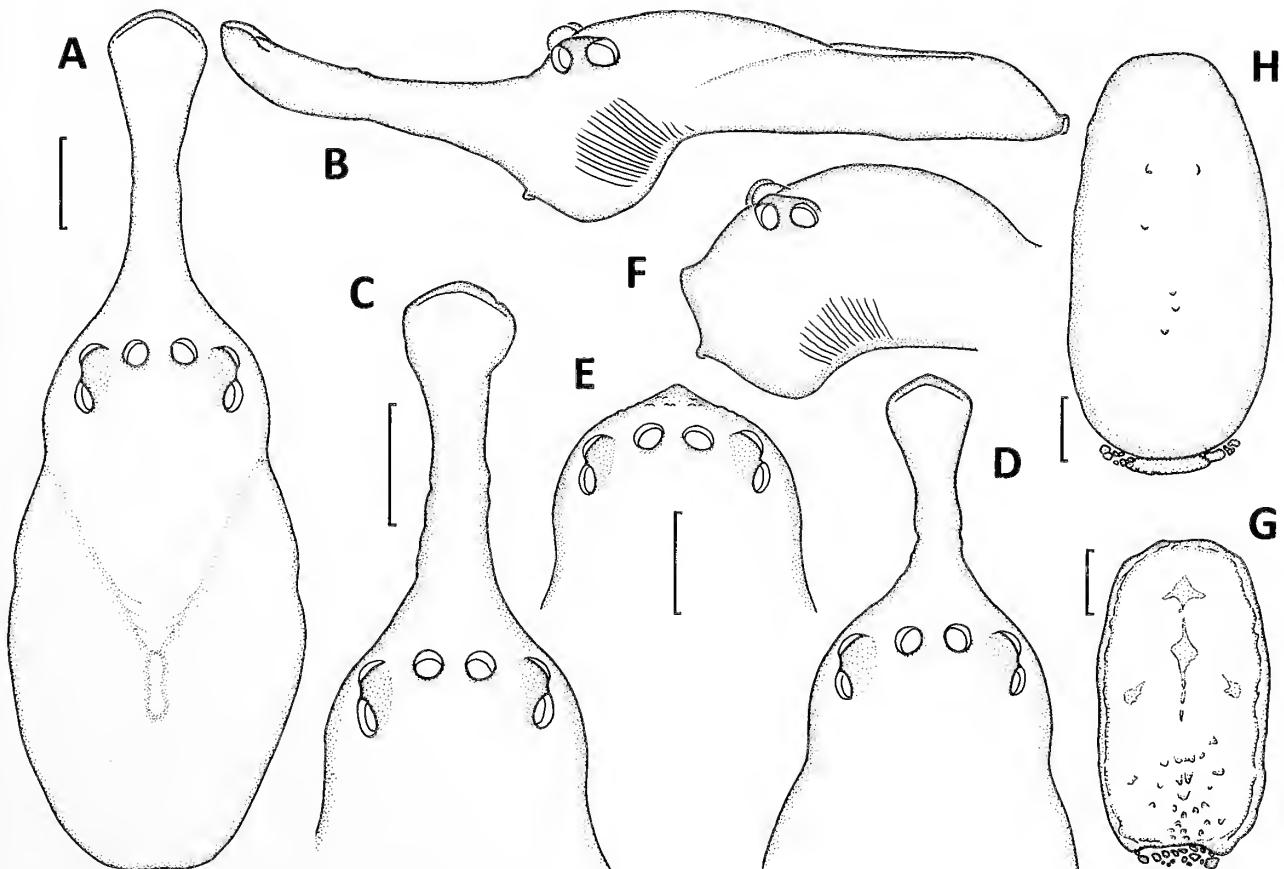


Fig. 2. *Perania annam* sp. nov., male holotype (A-B, H), male paratypes (C-D), female "allotype" (E-G). (A) Carapace, dorsal view. (B) Same, lateral view. (C-E) Anterior portion of carapace, dorsal view. (F) Same, lateral view. (G-H) Dorsal scutum of opisthosoma, dorsal view. Scale lines 1.0 mm (A-B; C-D; E-F; G-H).

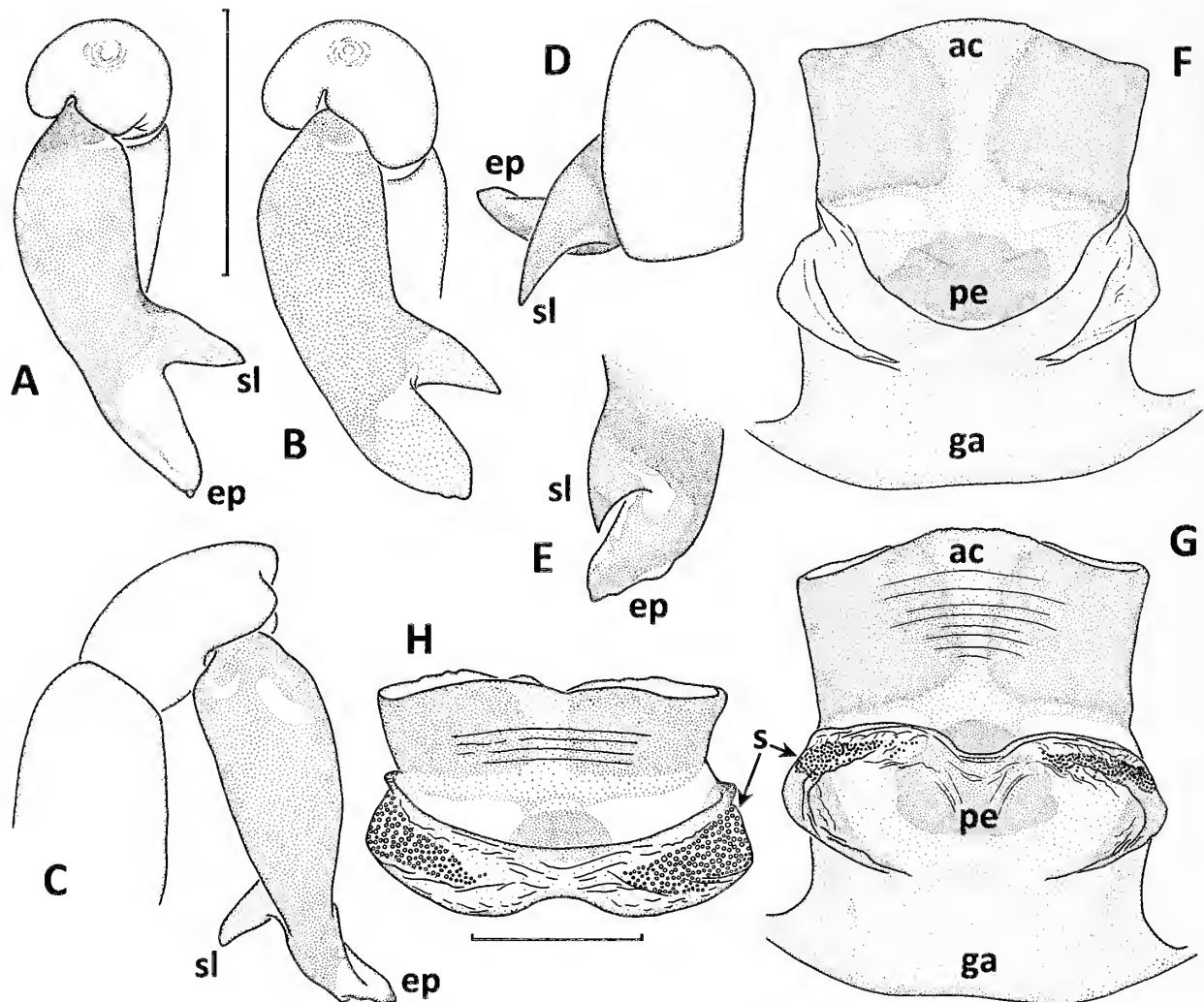


Fig. 3. *Perania annam* sp. nov., male paratype (A), male holotype (B-E), female allotype (F-H). (A-B) Distal portion of left palp, distal view. (C) Same, prolateral view. (D) Left cymbium and palpal organ, dorsal view. (E) Apex of embolus, retrolateral view. (F) Vulva, dorsal view. (G) Same, ventral view. (H) Same, anterior view. Abbreviations: ac = anterior collar; ep = embolic part; ga = genital atrium; pe = posterior extension of anterior collar; s = spermatheca with gland pores; sl = subterminal lamella. Scale lines 0.5 mm (F-H), 1.0 mm (A-E).

and flattened median process projecting forward and slightly upward, occupying 34% of carapace length, its distal margin broadly arched (Fig. 2A-B). Fovea indistinct and narrow, including two shallow pits (Fig. 2A). Total length 15.88. Carapace 8.73 long, 3.09 wide, its cephalic portion only slightly domed (Fig. 2B). Eye sizes and interdistances: PME 0.28 long, separated by 0.24; ALE 0.28 long; ALE-PLE 0.15; PLE 0.37 long, separated by 1.42. Labium 0.98 long, 1.27 wide. Sternum 3.53 long, 2.25 wide; sternal apophysis anvil-shaped. Chelicerae without modifications; two small teeth distal to median lamina.

Palp 5.42 long (1.67+0.71+2.16+0.88). Cymbium (Fig. 3D) short, with indistinct retrodorsal lobe (apex). Palpal organ (Fig. 3B-E) strongly modified: bulbus and base of embolus of same thickness, without constriction between them; apex of embolus compressed and deeply

split into a triangular, acutely pointed subterminal lamella and a longer and basally wider embolic part with a small, narrowly rounded tip.

Legs 3421. About 50 dark conical setal bases of various sizes prolaterally to ventrally on metatarsus I, about 30 shorter ones proventrally on tibia I; about 25 ones on metatarsus II and six on tibia II. All leg femora ventrally rugose (with wart-like hair bases); palpal femur essentially smooth. Paired leg claws with a row of 11-13 teeth on anterior legs, 8-9 on posteriors; unpaired leg claws with one denticle. Leg I 22.54 long (6.96+2.45+6.76+4.61+1.76), leg II 17.90 long (5.25+1.96+5.10+4.02+1.57), leg III 13.43 long (4.02+1.47+3.43+3.24+1.27), leg IV 16.62 long (5.00+1.57+4.51+4.22+1.32).

Opisthosoma 7.16 long, 3.92 wide. Dorsal scutum (Fig. 2H) exceptionally narrow, 5.88 long, 2.99 wide, somewhat oval, quite smooth, its surface with only few

indistinct elevations. Most lateral microplates flat, only a posterolateral one on each side of second band from above slightly elevated. Most microplates in bands on posterior side of opisthosoma closely packed, those in uppermost band largely fused into strap-like plate (Fig. 2H). Pulmonary plate 4.02 long, 3.33 wide; genital region flat. Anterior pair of ventrolateral plates largely free, only their posterior tips fused with margin of pulmonary plate. Postgenital plate 0.29 long, completely fused to posterior margin of pulmonary plate, both linked by a sclerotised suture. Preanal plate well developed, 0.78 long, 1.27 wide. Anal plate 1.23 long, 1.62 wide.

Description of female: As in male, except for the following. Total length 12.94. Carapace 5.29 long, 3.04 wide; cephalic portion more strongly domed than in male, with a short but distinct conical hump on clypeus occupying about 4% of carapace length (Fig. 2E-F). PME 0.34 long, 0.21 apart; ALE 0.30 long; ALE-PLE 0.10; PLE 0.30 long, 1.57 apart. Fovea indistinct, with only one shallow pit. Labium 0.98 long, 1.76 wide. Sternum 3.04 long, 2.11 wide. Palp 4.26 long (1.27+0.59+0.98+1.42). Legs 3421; metatarsus I with about 25 conical setal bases of different sizes prolaterally and proventrally, tibia I with seven quite small ones prolaterally, metatarsus II with six very small ones prolaterally and proventrally; all conical setal bases weaker than those in males. Paired leg claws with a row of 9-14 teeth. Leg I about 17.5 long [5.20+1.82+5.10+3.73+1.7? (distal half missing)], leg II 14.80 long (4.31+1.62+4.12+3.28+1.47), leg III 11.32 long (3.28+1.27+2.84+2.75+1.18), leg IV 14.07 long (4.07+1.37+3.82+3.58+1.23).

Opisthosoma 7.65 long, 4.41 wide; several microplates in posterior half larger than others, slightly elevated and conical; microplates on posterior side of opisthosoma not forming strap-like horizontal plates. Dorsal scutum (Fig. 2G) 4.51 long, 2.55 wide, its anterior margin relatively wider and its surface with more pronounced elevations than in males. Anterior opisthosomal plate completely fragmented into microplates (nine of them slightly larger than others). Pulmonary plate 3.24 long, 3.04 wide. Preanal plate small, spindle-shaped, 0.15 long, 0.69 wide. Anal plate 1.23 long, 1.57 wide.

Vulva (Fig. 3F-H) with very long anterior collar, median zone of its dorsal and ventral walls distinctly lighter than lateral zones, posteriorly extended into a large and thick sclerite; transition between anterior collar and its posterior extensions weakly sclerotised and weakly pigmented, posterior margin of extension in dorsal wall widely rounded. Spermathecae and ventral wall of genital atrium lightly and uniformly pigmented, with a transparent zone between them. Spermathecae elliptical, with a distinct and wide median invagination in common anterior margin and with inclined posterior margins; anterolateral sides with relatively small porepatches on flat surface.

Variation: Carapace length in three males (one female) ranges 6.57-8.73 (5.29), carapace width 2.75-3.09 (3.04). In two males (including the holotype) the cleft between the subterminal lamella and the embolic part of the palpal organ is acute at its base (Fig. 3B), in the third male it is narrowly rounded (Fig. 3A). The number of conical hair bases on tibia II of males ranges 3-6. Variation in the shape of clypeus modifications of males see Fig. 2A, C-D. All three males have most microplates in the uppermost band on the posterior side of the opisthosoma fused; one of them (a paratype) also has fused microplates in the second band from above. In all males the postgenital plate is relatively long (in comparison with males of other *Perania* spp.) and completely fused to the pulmonary plate.

Remarks: When we received the specimens, they all had their opisthosomata detached, widely cut open and the gonads removed for an examination of the chromosomes. This may have caused some minor deformation of the dorsal plates which may make them look slightly narrower than on intact specimens. The holotype has all legs of the left side missing, the allotype all legs on the right side. The only available female (the allotype) has its only remaining tarsus I incomplete. Since its tarsi II-IV are each one millimetre shorter than those of the male holotype, we assume that this is also the case in tarsus I. This puts its length at 1.7 mm, and the entire length of leg I at 17.5 mm.

Relationships: Males of *P. annam* sp. nov. and *P. utara* Schwendinger, 2013 (from Sumatra) share the conspicuous presence of conical setal bases on metatarsus II (not present in males of other congeners), but this is certainly a homoplasy. The strongly apomorphic palps of *P. annam* sp. nov. and *P. egregia* are phylogenetically much more informative than non-genital characters and clearly show that these two species are very closely related. This is also reflected in the female copulatory organs: the dorsal and ventral wall of their anterior collar each has a posterior extension that ends in a more or less pronounced sclerite, the ventral one partly covering the entrance to the spermathecae. Such structures were not observed in other congeners. *Perania egregia* occurs at the northeastern periphery of the previously known range of the genus and thus is – together with *P. quadrifurcata* Schwendinger, 2013, found a bit further south (see Schwendinger, 2013: fig. 1) – the geographically closest conspecific species of *P. annam* sp. nov.

Distribution: This species is known only from Dalat (= Da Lat; exact locality unknown; approximately 11°57'N, 108°26'E), situated in the southern part of the Central Highlands of Vietnam, at about 1500 m altitude (Fig. 1, inverted triangle). Further *Perania* species can be expected to occur in Vietnam, Cambodia and Laos.

Lamania bokor sp. nov.

Figs 4-5

Holotype: MHNG (sample THKH-13/06); male; Cambodia, Kampot Province, Phnom (= Mount) Bokor, Popokvil Waterfall ($10^{\circ}39'34''N$, $104^{\circ}03'05''E$), 910 m; 24.XII.2013; leg. P. Schwendinger.

Paratypes: 1 male, 6 females (MHNG) collected together with the holotype. – 1 female (NMP), Phnom Bokor ($10^{\circ}37'42''N$, $104^{\circ}05'36''E$), 700 m; 14.XI.2012; leg. O. Košulič.

Etymology: Named after the mountain on which the types were found. Noun in apposition.

Diagnosis: The new species differs from *L. kraui* Shear, 1978 by larger size [carapace length and width in *L. bokor* sp. nov. 1.95-2.09 and 1.54-1.67 (n=9), in *L. kraui* 1.37-1.61 and 1.09-1.28 (n=22)] and by the cephalic part of the carapace being posteriorly more strongly elevated in both sexes (Fig. 4B cf. Fig. 6A). Embolus of palpal organ with quadrangular (instead of triangular) subterminal lamella and with narrower, scale-like (instead of wide and truncate) embolic part (Fig. 4D-H cf. Fig. 6E-H). Vulva not clearly distinguishable from that of *L. kraui* (Fig. 5 cf. Fig. 7; see also “Taxonomic remarks”).

Description of male (holotype): Colour (in alcohol) of sclerotised parts mostly dark brown, except for slightly lighter leg patellae and apical portions of leg femora and tibiae, and distinctly lighter basal (bulbous) part of palpal organ; membranous parts of opisthosoma light brown. Clypeus and thoracic part of carapace without modifications, cephalic part of carapace clearly highest in its posterior portion (Fig. 4B). Carapace with numerous elevated setal bases; fovea not discernible (Fig. 4A). Total length 4.46. Carapace 1.98 long, 1.58 wide. Eye sizes and interdistances: PME 0.15 long, separated by 0.08; ALE 0.15 long; ALE-PLE 0.03; PLE 0.13 long, separated by 0.76. Labium 0.47 long, 0.65 wide. Sternum 1.13 long, 1.10 wide; sternal apophysis a small rounded knob carrying strongly conical setal bases. Chelicerae without modifications; two indistinct teeth distal to median lamina.

Palp 1.96 long ($0.66+0.35+0.57+0.38$). Cymbium (Fig. 4D) short, its apex with two distinct lobes of similar size. Tibia with low, wide proventral process (Fig. 4D); its ventral side with smooth and plane surface (zone of contact with palpal organ, Fig. 4E-F). Palpal organ with large, globular base; embolus short and bifid, its proximal portion with a low boss on anterior side (Fig. 4F, H), its apical portion divided into a quadrangular subterminal lamella with pointed, slightly outward-bent dorsodistal corner, and into a relatively narrow (about as wide as subterminal lamella at base) scale-like embolic part (Fig. 4D-H).

Legs 3241. No conical setal bases present on tibiae

and metatarsi of anterior legs; all articles of legs and palps with essentially smooth surface (apart from pit-like setal bases). Leg I with thin but distinct ventral scopula of short, sigmoid serrate setae spread over almost entire length of tarsus and over distal two-thirds of metatarsus (see paragraph “Scopulae in Tetrablemmidae”); other legs without scopula. Paired leg claws with a row of 11-12 teeth on anterior legs, 8-9 on posteriors; unpaired leg claws with one denticle. Leg I 7.37 long ($2.27+0.66+2.08+1.51+0.85$), leg II 6.29 long ($1.92+0.63+1.64+1.34+0.76$), leg III 5.41 long ($1.61+0.60+1.31+1.23+0.66$), leg IV 7.14 long ($2.17+0.63+1.92+1.73+0.69$).

Opisthosoma 3.02 long, 2.17 wide. Dorsal scutum large, 2.90 long, 2.17 wide, mostly smooth except for numerous pit-like setal bases and several indistinctly raised mounds (pair near posterior margin being largest). Microplates on anterior side strongly conical, all others flat (Fig. 4B). Three strap-like lateral plates (lower one longest, median one shortest) and three strap-like posterior plates (upper one longest, lower one shortest). Pulmonary plate 2.14 long, 1.58 wide, completely fused with stigmal plates, with anterior pair of ventrolateral plates and with postgenital plate (linked by a sclerotised suture); posterior part evenly covered with wart-like setal bases, booklung covers smooth, anterior part carrying several distinct conical setal bases, including three (on right side) and four (on left side) large ones [corresponding to “large, black, seta-bearing teeth” in *L. kraui* (see Shear, 1978: 43, fig. 116 and Fig. 6B)] above booklung covers (Fig. 4C, minor conical setal bases omitted); genital region elevated to a low volcano-shaped mound with the genital orifice in its centre. Median ventrolateral plates separated, with a single very short but wide bridge fragment between them (see Schwendinger, 2013: 657, 659, fig. 36A-D for explanation). Preanal plate 0.30 long, 0.76 wide, fused with posterior ventrolateral plates (discernible by darker colour and different surface texture). Anal plate 0.28 long, 0.74 wide.

Description of female (allotype): As in male, except for the following. Colour (in alcohol) slightly darker than in male holotype, membranous parts of opisthosoma yellowish brown. Total length 4.55. Carapace 1.94 long, 1.59 wide. Eye sizes and interdistances: PME 0.14 long, separated by 0.10; ALE 0.15 long; ALE-PLE 0.03; PLE 0.14 long, separated by 0.80. Labium 0.44 long, 0.66 wide. Sternum 1.20 long, 1.10 wide.

Palp 1.83 long ($0.52+0.25+0.38+0.68$), without claw. Legs 3241. Leg I without scopula. Paired leg claws with a row of 13-14 teeth on anterior legs, eight on posteriors. Leg I 7.08 long ($2.17+0.63+1.95+1.48+0.85$), leg II 6.12 long ($1.86+0.60+1.58+1.32+0.76$), leg III 5.22 long ($1.58+0.57+1.23+1.18+0.66$), leg IV 7.11 long ($2.16+0.63+1.89+1.72+0.71$).

Opisthosoma 3.12 long, 2.17 wide. Dorsal scutum 2.77

long, 1.73 wide, distinctly more rugous than in males, pits and elevations more pronounced. Microplates on anterior side smaller and less strongly elevated than in males. Four strap-like lateral plates (uppermost and lowermost longest, second from below shortest) and three strap-like posterior plates. Pulmonary plate 1.89 long, 1.48 wide, not fused with postgenital plate; genital region essentially flat, posterior edge elevated above postgenital plate. Postgenital plate 0.19 long, 0.71 wide. Two bridge fragments lying between pair of median ventrolateral plates. Preanal plate 0.36 long, 0.71 wide. Anal plate 0.28 long, 0.66 wide.

Vulva (Fig. 5 showing five paratypes) with short, wide genital atrium with relatively large porepatches on lateral sides and with a largely transparent (except for base and lateral margins), flattened anterior collar.

Taxonomic remarks: The vulva of *L. bokor* sp. nov. is very similar to that of *L. kraui*, and at present a clear distinction cannot be made. Nevertheless two differences were observed which may or may not be consistent and of diagnostic value: 1. The cuticular bases of the gland ducts that stick out of the pores of the porepatehes are evenly tapering in *L. bokor* sp. nov., whereas in *L. kraui* they are shaped like papillae, basally wide and abruptly tapering to a tiny pointed tip. 2. In the *L. bokor* sp. nov. vulvae examined the anteromedian wall (roof) of the genital atrium (between the spermathecae and below the anterior collar) in dorsal view is more distinctly arched anteriad than in *L. kraui*.

Variation: Carapace length in two males (seven females) ranges 1.95-1.98 (1.94-2.09), carapace width

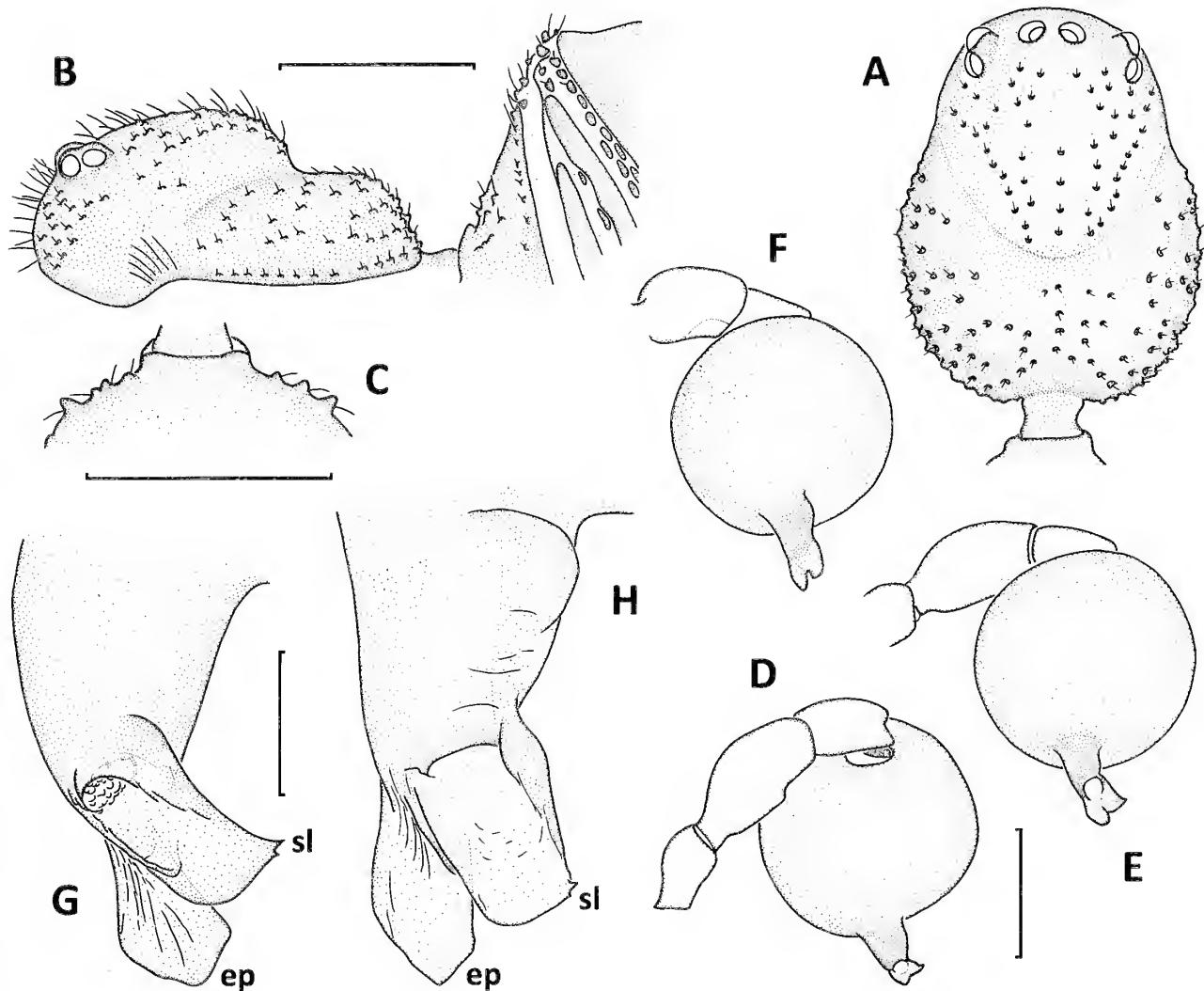


Fig. 4. *Lamania bokor* sp. nov., male holotype. (A) Carapace, dorsal view. (B) Same, plus anterior part of opisthosoma showing conical setal bases, lateral view. (C) Anterodorsal side of pulmonary plate showing enlarged conical setal bases above booklung covers (other setal bases omitted), dorsal view. (D) Distal portion of left palp, prodorsal view. (E) Same, proventral view. (F) Same, proventral and slightly posterior view. (G) Apex of left embolus, proventral view. (H) Same, prolateral and slightly posterior view. Abbreviations: ep = embolic part; sl = subterminal lamella. Scale lines 0.1 mm (G-H), 0.5 mm (D-F), 1.0 mm (A-B; C).

1.54-1.58 (1.56-1.67). Both males and one female have only one bridge fragment between both median ventrolateral plates, five females have two, in the remaining female this is not visible due to a shrunken opisthosoma. The number of enlarged conical setal bases above the booklung covers ranges 3-5. Variation in the shape of the vulva of five females is shown in Fig. 5A-E.

Relationships: The new species is most similar (with respect to shape of carapace and of palpal organ) and probably most closely related to an undescribed species from southern Thailand (Phang Nga Province), which is also geographically the closest congeneric species to *L. bokor* sp. nov. available at present. The localities of both species are separated by about 1200 km on the land route and by over 600 km in a direct line across the Gulf of Thailand. The latter route may have been open to spiders in periods of lowered sea levels during the Cenozoic, but it is quite unlikely that the habitats there were suitable for colonization by *Lamania*. Extant

Lamania spp. have only been found on the floor of humid evergreen broadleaf forests. Despite intensive sifting of leaf litter in evergreen forests of other parts of Thailand, no *Lamania* (or *Paculla*) have been found there.

Distribution and habitat: This species is only known from two localities (separated by about 7 km) on Mount Bokor, at the southern end of the Elephant Mountains, near the coast of Cambodia (Fig. 1, triangle). The specimens examined were sifted from leaf litter and collected from inside pieces of decaying wood on the floor of evergreen forests between about 700 m and 900 m.

Lamania kraui (Shear, 1978)

Figs 6-7, 8A, C-E, J

Paculla kraui Shear, 1978: 41-43, figs 112-120 (description of female and male). – Bourne, 1980a: fig. 26 (palp of male paratype redrawn from Shear, 1978: fig. 118).

Lamania kraui (Shear, 1978). – Lehtinen, 1981: 21 (transfer).

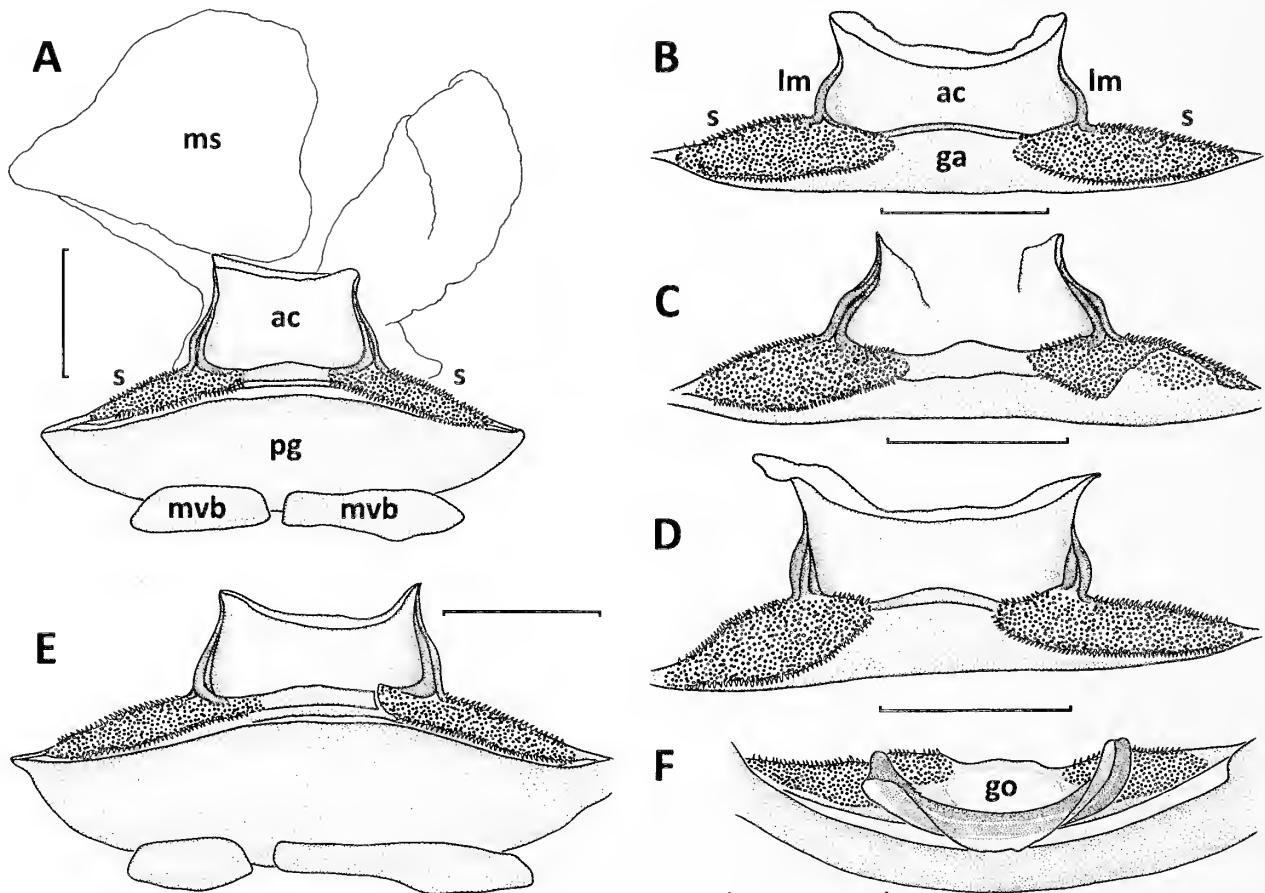


Fig. 5. *Lamania bokor* sp. nov., vulvae of five female paratypes, dorsal view (A-E) and anterior view (F). (A) Entire vulva with membranous sacs, postgenital plate and bridge fragments of median ventrolateral plates. (E) Same, without membranous sacs. (B-F) Vulva without membranous sacs (anterior margins of anterior collar and dorsal wall of right porepatch ruptured in C; roof of genital atrium broken in E). Abbreviations: ac = anterior collar; ga = genital atrium; go = genital orifice; lm = lateral margin of anterior collar; ms = membranous sac; mvb = bridge fragment of median ventrolateral plate; pg = postgenital plate; s = spermatheca with membranous bases of gland ducts sticking out of pores. Scale lines 0.2 mm.

Material examined: PENINSULAR MALAYSIA: MCZ 21760 (lot 3452); female holotype; Pahang, Temerloh District, Krau Game Reserve, 30.VI.1973, leg. J. Feagle. – MCZ 25049 (lot 3452); male paratype; same data as for holotype. – MHNG (sample SIM-01/12); 7 males, 6 females, 1 juvenile; Pahang, Bukit Charas, about 3 km north of Panching, $3^{\circ}54'41.1''N$, $103^{\circ}08'50.2''E$, 60 m (evergreen forest on limestone); 9./10.VII.2001; leg. P. Schwendinger. – MHNG (sample MAL-04/08); 4 males, 1 female; Pahang, Bukit

Charas, 60 m (rain forest remnants at foot of limestone hill); 3./4.VI.2004; leg. P. Schwendinger. – MHNG (sample WM93-1a); 2 females; Pahang, Taman Negara, Tembeling Trail, 90-120 m, forêt primaire (tamisage); 10./13.III.1993; leg. I. Löbl & F. Calame. – MHNG (sample WM93-2a); 2 males, 2 females; Pahang, Taman Negara, Gunung Tahan Trail, 90-130 m, forêt primaire (tamisage dans un ravin); 11.III.1993; leg. I. Löbl & F. Calame. – MHNG (sample MAL-04/13); 26 males, 14 females, 3 juveniles; Kelantan, 1 km south of Gua

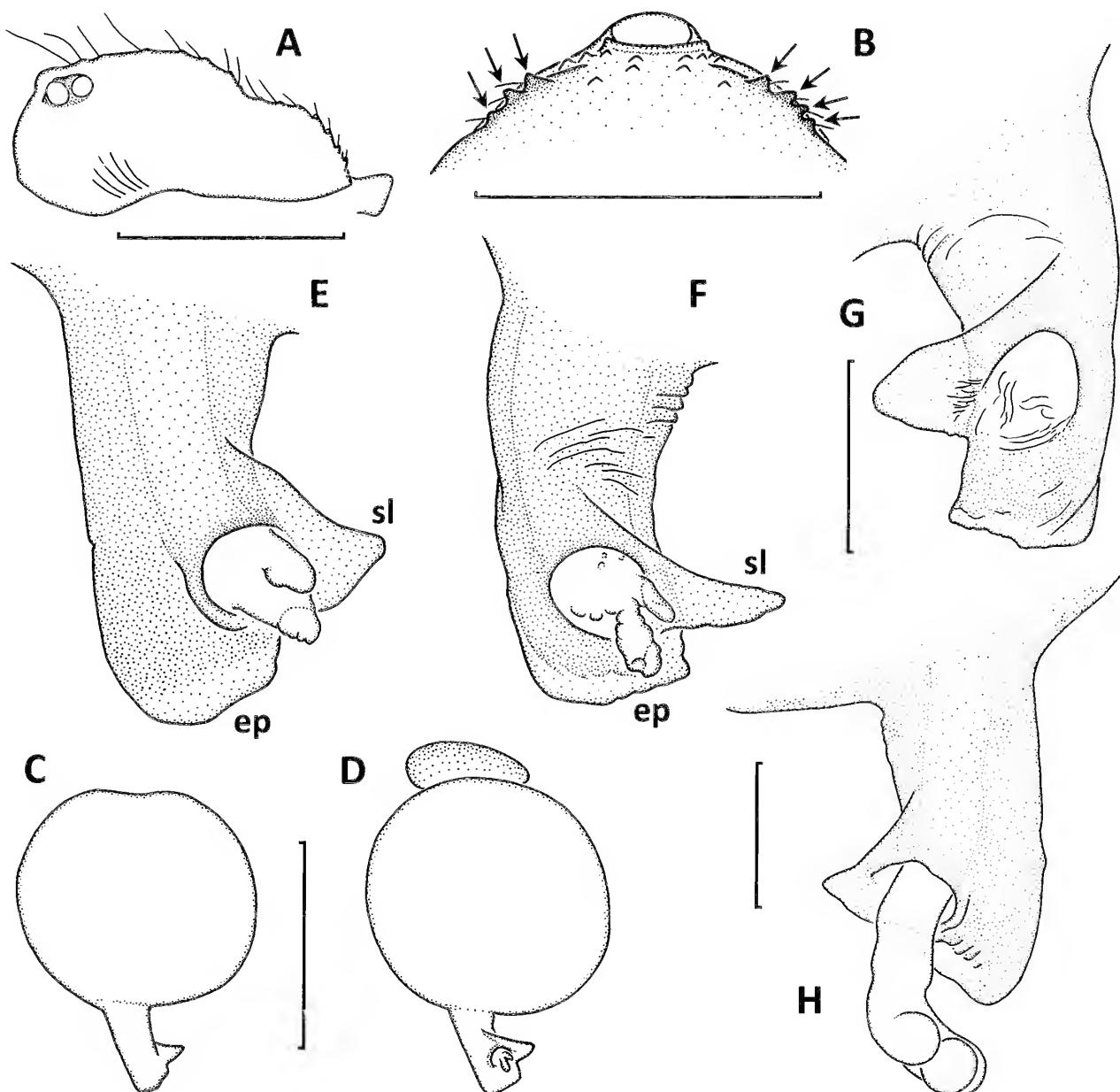


Fig. 6. *Lamania kraui* Shear, 1978, male paratype (A-G) and male from Gua Musang (H). (A) Carapace, lateral view. (B) Anterodorsal side of pulmonary plate showing enlarged conical hair bases (those above booklung covers indicated by arrows). (C) Right palpal organ, retrolateral view. (D) Left palpal organ, prolateral and slightly distal view. (E) Left embolus, prolateral and slightly ventral view. (F) Same, prolateral and slightly more dorsal view. (G) Right embolus, prolateral and slightly distal view. (H) Right embolus, prolateral and slightly ventral view. Abbreviations: ep = embolic part; sl = subterminal lamella. Scale lines 0.1 mm (E-G; H), 0.5 mm (C-D), 1.0 mm (A; B).

Musang railway station, $4^{\circ}52'31.3''N$, $101^{\circ}58'06.5''E$, 120 m (rain forest remnants at foot of limestone hill); 13./14.VI.2004; leg. P. Schwendinger. — MHNG (sample MAL-04/11); 3 males, 7 females, 2 juveniles; Kelantan, 8 km southwest of Dabong, Gunung Stong, $5^{\circ}20'22.5''N$, $101^{\circ}58'15.2''E$, 200 m (rain forest near stream); 10.VI.2004; leg. P. Schwendinger. — MHNG; 13 males, 15 females, 1 juvenile; Kelantan, about 30 km south of Kota Baharu, 8 km west of Kampung Padang Pak Amat, Jeram Pasu Waterfall, 100 m, rain forest; 10./11.I.1999; leg. P. Schwendinger. — MHNG (sample THMA-08/01); 27 males, 32 females, 2 juveniles; Terengganu, Pulau Perhentian Besar, trail across island, from Teluk Pauh to Teluk Dalam, $5^{\circ}53'51''N$, $102^{\circ}44'53''E$, 50-100 m, rain forest; 2.-4.VI.2008; leg. P. Schwendinger. — THAILAND: MHNG; 4 males, 7 females; Narathiwat Province, Waeng District, Hala-Bala Wildlife Sanctuary, 200 m, rain forest; 8.I.1999; leg. P. Schwendinger.

Taxonomic remarks: When comparing specimens of *L. bokor* sp. nov. with the types of *L. kraui*, we found that the original description of the latter species is incomplete, incorrect and misleading in the following points. Two “large, black, setae-bearing teeth” (= conical setal bases; thickness of setae much exaggerated in Shear, 1978: fig. 116) are present on both sides of the pulmonary plate above the booklung covers in the female holotype (and in only few other conspecific

specimens), whereas the male paratype has three (on its left side) and four (on its right side; Fig. 6B) slightly smaller such tubercles at the same place (not mentioned in the original description). The number of these tubercles in *L. kraui* specimens examined ranges from one to four, most specimens have three, many specimens have an unequal number of such tubercles on both sides. With regards to this presumably apomorphic character, *L. kraui* does not differ from *L. bokor* sp. nov., which is an indication that both species are closely related (belong to the same lineage). The bulbous base of the palpal organ is not as distinctly flattened on its frontal side as shown in Shear (1978: fig. 118), it is in fact a quite regular globe (Fig. 6C-D). There are some proximal wrinkles (Fig. 6F-G) on the anterior side of the embolus, which can be indistinct, small (in the paratype) or large and bulging, giving the impression of a hump (as in the two males of *L. bokor* sp. nov. examined). The embolus does not have a narrow subterminal lamella that is narrowest at its base as illustrated by Shear (1978: fig. 118), in fact it is widest at its base (Fig. 6C-H). A dark, somewhat crescent-shaped area along the posterior margin of the distal half of the embolus (Shear, 1978: fig. 118) is not (or no longer) discernible on both palps of the paratype, nor on those of other conspecific males examined. The distal margin of the embolic part is not as distinctly jagged as shown for the left palpal organ of the paratype by Shear (1978: fig. 118); it is essentially straight, or with a very

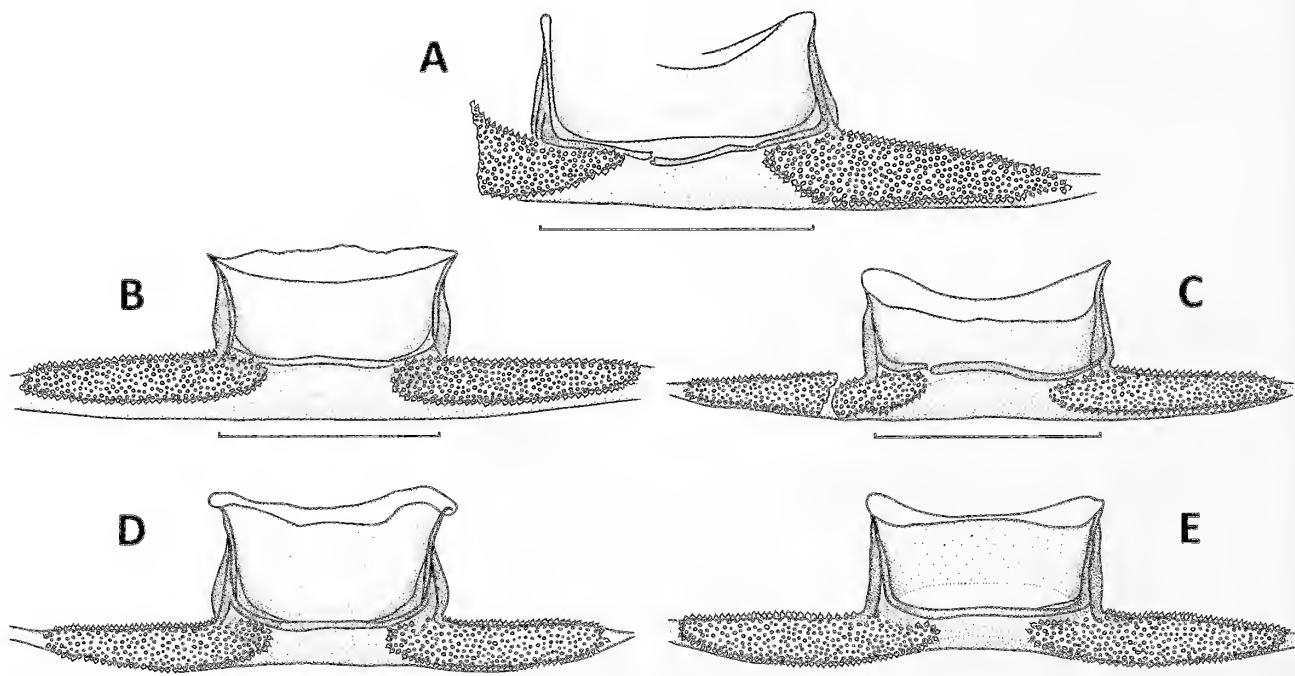


Fig. 7. *Lamania kraui* Shear, 1978, vulvae of five females, dorsal view. (A) Holotype (vulva detached from pulmonary plate, left side broken, roof of genital atrium broken, anterior margins of anterior collar ruptured or indiscernible). (B) Female from Charas Hill. (C) Female from Taman Negara (atrial roof and left porepatch broken). (D) Female from Gua Musang. (E) Female from Hala-Bala. Scale lines 0.2 mm.

wide angle in the middle (Fig. 6C-H). The two small medio-apical teeth shown there by Shear are in fact two peg-like columns (or the split tip of an otherwise cylindrical column) of coagulated sperm pushed out of the opening of the spermophore (Fig. 6E-F), and thus they are not part of the embolus per se. These columns are not present on the right palp¹ of the same specimen (Fig. 6G). On the palps of a few other conspecific males we found a single cylindrical column (as wide as the diameter of the spermophore opening) of coagulated sperm which resembles a vermicelli noodle pressed out of the pore of a sieve (Fig. 6H). This was presumably also present on the left palp of the paratype before the larger part of the “noodle” broke off. The original illustration of the holotype vulva (Shear, 1978: fig. 120) does not show the two large spermathecae (Fig. 7A) and it does not show the second distal margin of the anterior collar (Fig. 7A; see Discussion) which would explain that this structure (which is not the entire vulva but only part of it) is not an “open sclerotised tube” as described by Shear (1978: 43).

Variation: Carapace length in ten males (plus the male paratype, in parenthesis) ranges 1.37-1.53 (1.43), in ten females (plus the holotype, in parentheses) 1.46-1.61 (1.57). Carapace width in males ranges 1.09-1.20 (1.14), in females 1.11-1.28 (1.20). Variation in the shape of the vulva of five females from different localities is shown in Fig. 7.

Distribution: This species is widely distributed in the central part of Peninsular Malaysia and northwards to, and across, the Thai border. It also occurs on Perhentian Island off the northeastern corner of Malaysia (Fig. 1, circles). Closely related (same lineage, with enlarged setal bases on anterior side of pulmonary plate and with both apical parts of embolus being equally long), undescribed *Lamania* species are present to the north of its range. Undescribed species, which are not closely related (different lineage without enlarged setal bases on anterior side of pulmonary plate and with unequally long apical parts of embolus), occur to the south and

to the east of the range of *L. kraui*. All other *Pacullini* specimens in the MHNG collection from the southern and western parts of Peninsular Malaysia belong to the genus *Paculla*.

DISCUSSION

Vulvae in *Lamania*

At first glance the vulvae of *Lamania bokor* sp. nov. and *L. kraui* look very different from those of *Perania* spp., but at closer examination similarities in their structure become obvious. Both genera have a wide, undivided genital orifice and atrium [according to Lehtinen (1981: 18) the genital orifice in *Paculla* spp. is paired, divided by a septum], which in the two *Lamania* spp. examined is much shorter than in most *Perania* spp. On each of the lateral sides of the genital atrium of *Lamania* there is an area perforated with gland pores (clearly visible by membranous bases of gland ducts sticking out of the pores; not observed in *Perania* spp.), which extends over the anterior wall (roof of the genital atrium) and equally far backward over most of the anterior and posterior walls [Fig. 5C (dorsal wall of right poreplate ruptured, exposing ventral wall behind), F]. As these are the only parts of the *Lamania* vulva into which glands empty, they must be considered as the spermathecae. They are paired and roughly at the same position as in *Perania*, but more widely separated from each other. Anteriorly between both spermathecae extends a structure which Shear (1978: 43) called an “open sclerotised tube”. At close inspection this proves to be a closed, flattened collar, much like the anterior collar of the *Perania* vulva and probably homologous, but much less sclerotised and unpigmented apart from its base (only visible in anterior view, Fig. 5F) and its sharply bent lateral margins which resemble flagposts in dorsal view (Figs 5, 7). The similarity with the leathery anterior collar of *Perania* is not immediately evident, because the largely transparent dorsal and ventral walls of the anterior collar of *Lamania* lie close to each other and both are bent ventrad against the inside surface of the pulmonary plate (Fig. 5F).

The paired membranous sacs anterior to the genital atrium and anterior collar of *Lamania* are delicate (easily destroyed during preparation) and completely transparent (Fig. 5A). Their function is unclear, as is their connection with the vulva proper. Since there is no evidence for glands emptying into these sacs, it is questionable if they function as sperm-storing organs as suggested by Shear (1978: 39, 43) and Lehtinen (1981: 17). Within the Tetrablemmidae such membranous sacs associated with vulvae are also found in *Paculla* (see Bourne, 1981: fig. 10) and Tetrablemminae (see e.g., Lehtinen, 1981: figs 32-37; Burger, 2008: figs 11, 25), but not in *Perania* and apparently also not in *Sabahya*.

Apparently not all *Lamania* vulvae are composed of the same elements as in the species treated here. *Lamania*

¹ Another species described in the same paper and presumably based on an atypical specimen is *Singaporemma singularis* Shear, 1978. The embolus of the male holotype (the only male then available) is said – and illustrated – to be “cuing sharply posteriorly” (Shear, 1978: 39, figs 109-110), i.e. being bent at right angles at about mid-length. The MHNG houses five *Singaporemma* males from three localities on Singapore Island, one of them (the McRitchie Reservoir) being the type locality of *S. singularis* (the others are the Botanical Gardens and the Singapore Island Country Club, both close to the type locality). All these males have essentially straight emboli (only slightly bent ventrad) on both palps. Therefore we assume that Shear described a deformed embolus. An examination of the other palp of the holotype is desirable.

bernhardi (Deeleman-Reinhold, 1980) from eastern Borneo seems to lack porepatches (see Deeleman-Reinhold, 1980: fig. 6 and Lehtinen, 1981: fig. 23 – both illustrations remarkably dissimilar), and no pores were found in conspecific females (in MHNG) from the Sungai Wain Protected Forest and Bukit Bangkirai (near the type locality). We still know very little about vulva morphology in Pacullini Lehtinen, 1981.

Scopulae in Tetrablemmidae

Scopula hairs or dense groups of setae on the ventral side of tarsus I and/or metatarsus I of males of several tetrablemmid genera have been mentioned or illustrated several times in the literature. Deeleman-Reinhold (1980: fig. 5) shows a scopula in the distal part of metatarsus I (but not on tarsus I) of *Lamania bernhardi*; Bourne (1981: figs 5, 14) illustrated the same on tarsus I and metatarsus I of *Paculla wanlessi* Bourne, 1981 and *P. mului* Bourne, 1981; Lehtinen (1981: 23) mentioned a scopula on the tarsus I and metatarsus I of males of *P. cameronensis* Shear, 1978 and he illustrated (Lehtinen, 1981: fig. 29), but did not mention, a scopula on leg I of males of *Sabahya kinabaluana* Deeleman-Reinhold, 1980; Burger (2008: 256, fig. 6) presented a scopula on tarsus I of males of *Ablemma unicornis* Burger, 2008.

These scopulae are moderately dense groups of what we here call “short sigmoid serrate setae”. We found this kind of setae in both sexes of all Tetrablemmidae examined, being situated mostly ventrally (very few laterally and dorsally) on all leg tarsi (in Pacullinae also on metatarsi) of the anterior legs. They occur together with other serrate setae on the same leg segments, but those are distinctly longer, slightly bent and arise at a narrower angle (Fig. 8A-I) (see Shear, 1978: fig. 112). Both types of setae have denticles (barbs) only on their ventral (proximal) side, whereas pinnate setae (present on metatarsi of posterior legs of Pacullinae) have denticles on two opposing sides (Fig. 8J). Shear (1978: fig. 112) illustrated long bent serrate setae on the tip of leg I of *L. kraui*. One of them is shown to arise from the claw base, which appears to be a misinterpretation by the artist. Claw bases in spiders do not carry hairs.

In adult males of many Pacullini [most distinctly so in species of *Lamania* (Fig. 8E) and *Sabahya* (Fig. 8G), less so in *Paculla* (Fig. 8F), not so in *Perania* (Fig. 8B)] the short sigmoid serrate setae on the ventral side of tarsus I and metatarsus I are clearly more numerous than in females and juveniles (Fig. 8C-D), forming thin scopulae (Fig. 8E-G). This was observed in all *Lamania* species available to us [*L. bernhardi*, *L. bokor* sp. nov., *L. gracilis* Schwendinger, 1989, *L. kraui* (Fig. 8E), in *Sabahya kinabaluana* (Fig. 8G) and *S. bispinosa* Deeleman-Reinhold, 1980, in *Paculla cameronensis* (Fig. 8F), *P. granulosa* (Thorell, 1881), *P. mului* and *P. wanlessi*], as well as in several undescribed species of these genera. In one undescribed *Lamania* species from the southern

part of Peninsular Malaysia there is no scopula on tarsus I but only on metatarsus I.

In the Tetrablemminae we found a ventral scopula in the distal half of the slightly spindle-shaped tarsus I (but not on metatarsus I) of males of *Ablemma unicornis* (Burger, 2008: 256, fig. 6; Fig. 8H), *A. singalang* Lehtinen, 1981, *A. circumspectans* Deeleman-Reinhold, 1980, *Borneomma roberti* Deeleman-Reinhold, 1980 (Fig. 8I), *Pahanga lisari* Lehtinen, 1981, *Tetrablemma mardionoi* Lehtinen, 1981 (short and confined to distal third of tarsus I), and it presumably is also present in males of many other species of this subfamily. We could not find such a scopula in males of tetrablemmine species which do not have a swollen tarsus I: *Brignoliella michaeli* Lehtinen, 1981, *B. sarawak* Shear, 1978, *Hexablemma cataphractum* Berland, 1920, *Indicoblemma lannaianum* Burger, 2005, *Caraimatta sbordonii* (Brignoli, 1972), *Shearella browni* (Shear, 1978), *Singaporemma* cf. *singularis*, *Sulaimania vigelandi* Lehtinen, 1981 and *Tetrablemma loebli* Bourne, 1980b.

Considering the microstructure of these setae and the position on the legs where they aggregate, adhesive properties (though certainly much weaker than in the scopulae of e.g. theraphosid spiders) can be expected. They presumably provide a better grip on the female during copulation. The presence of leg scopulae in adult males, but not in penultimate males or adult females, is also known from other spider families, e.g. Liphistiidae, Atypidae, Antrodiaetidae, Ctenizidae, Idiopidae, Migidae, Actinopodidae, Hexathelidae. The scopulae of male liphistiids and also of males of the tetrablemmid *Brignoliella ratnapura* Shear, 1988 (not examined) appear to have a different (in addition to adhesion?) function: they are probably chemosensory (Foelix & Erb, 2010 and Foelix *et al.*, 2010; Shear, 1988).

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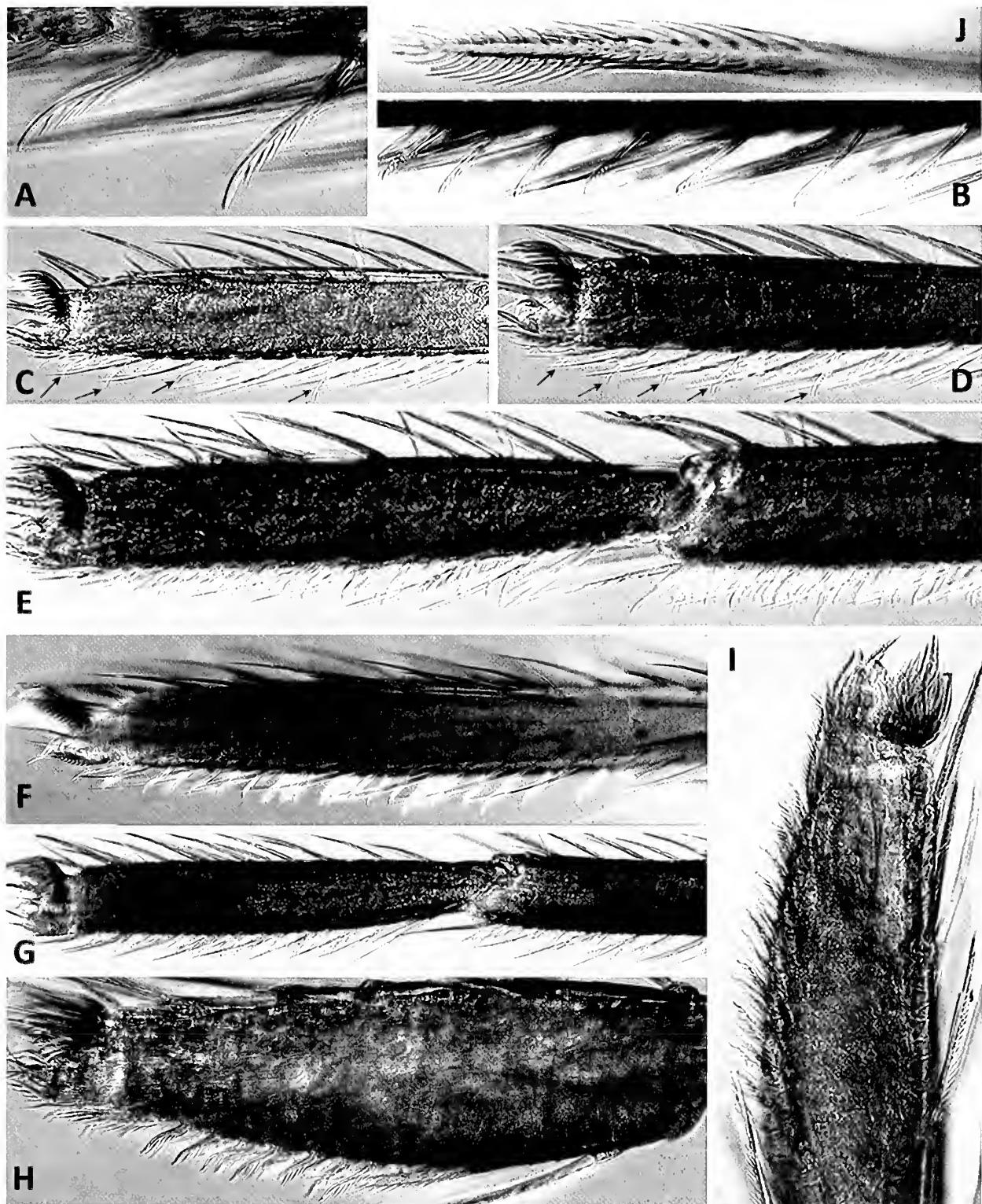


Fig. 8. Setae on legs of Tetrablemmidae. (A) *Lamania kraui* Shear, 1978, two short, sigmoid, serrate setae (SSSS) on tarsus I of subadult male from Gua Musang. (B) *Perania annam* sp. nov., scattered SSSS (not forming scopula) on tarsus I of male paratype. (C) *Lamania kraui*, scattered SSSS (indicated by arrows) on tarsus I of subadult male from Gua Musang. (D) *Lamania kraui*, scattered SSSS (indicated by arrows) on tarsus II of male from Gua Musang. (E) *Lamania kraui*, SSSS forming distinct ventral scopula on tarsus I and metatarsus I of male from Gua Musang. (F) *Paculla cameronensis* Shear, 1978, light scopula on tarsus I of male from Maxwell Hill. (G) *Sabahya kinabaluana* Deebleman-Reinhold, 1980, light scopula on tarsus I and metatarsus I of male from type locality. (H) *Ablemma unicornis* Burger, 2008, light scopula in distal half of tarsus I of male paratype. (I) *Borneomma roberti* Deebleman-Reinhold, 1980, distinct scopula in distal half of tarsus I of male from type locality. (J) *Lamania kraui*, pinnate seta on metatarsus III of female from Gua Musang.

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